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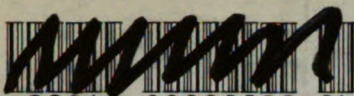
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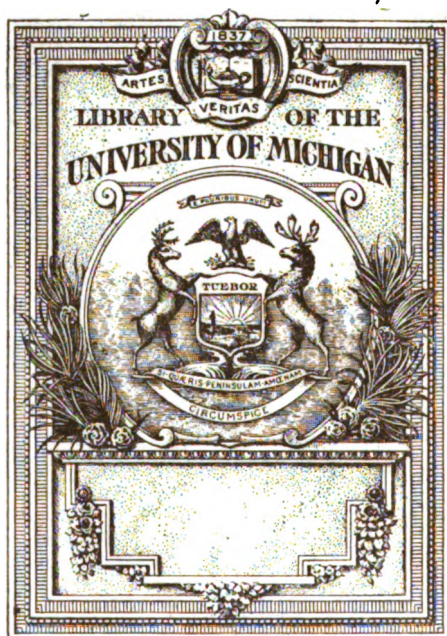
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JOURNAL OF ENTOMOLOGY AND ZOOLOGY



VOLUME IX, 1917

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THE JOURNAL OF ENTOMOLOGY AND ZOOLOGY

William A. Hilton, Editor

Claremont, California, U. S. A.

Another Record of a Small Whip Scorpion in California

M. L. MOLES

In April, 1916, Dr. W. A. Hilton collected some small whip-scorpions in the Pomona College Park at Claremont. These creatures were without eyes and yet they seemed to avoid forceps. They were able to run backwards or forwards with equal ease. On examination it was found that there were long hairs on the legs such as shown in the figure. Other specimens were afterwards found in one of the nearby canyons, and two specimens in the college collection were marked "C. Metz, in the mountains near Claremont."

Upon looking through the literature the species was determined to be *Trithyreus pentapeltis* Cook. In 1899 Dr. Hubbard collected some at Palm Springs under stones in the canyon near the stream. Those which we have found this year were under the dried oak leaves some distance from water. Cook gave the generic name *Hubbardia* which has not been sustained.

The following are the measurements of two types of the twenty or more specimens found.

Measurements—supposed Male:

- Length of whole body, 7.5 mm.
- Length of cephalothorax, 2 mm.
- Length of abdomen, 3 mm.
- Length of tail, 2.5 mm.
- Length of first leg, 8 mm.
- Length of maxillæ, 1.5 mm.
- Width of abdomen, 1 mm.
- Width of cephalothorax, 8 mm.

Measurements—Supposed Female and Juvenile, Fig. 1:

- Length of whole body, 4.5 mm.
- Length of cephalothorax, 1.5 mm.
- Length of abdomen, 2 mm.
- Length of tail, 1 mm.
- Length of first leg, 5.5 mm.
- Length of maxillæ, 2 mm.
- Width of cephalothorax, 6 mm.
- Width of abdomen, 1 mm.

Color of supposed Male—Cephalothorax and maxillæ, dark reddish brown. Abdomen and legs light yellow brown.

Color of supposed Female and Juvenile—All parts bright yellow brown.

Cephalothorax suboval, upper margin strongly concave at the sides and tapering to a point at the median line. Sides convex at upper edge; lower margin strongly convex. The cephalothorax is strongly chitinized, showing two small oval spots. The small suboval area between the chitinized cephalothorax and the abdomen is soft with five chitinized plates.

On the dorsal surface of each abdominal segment are two muscle depressions, while on the ventral surface the fourth, fifth and sixth segments have dark colored plates near the segmental divisions which are used for muscle attachments; besides the two muscle depressions.

The book-lungs openings are found on the ventral surface of the first abdominal segment, as is also the epigynum.

The caudal appendage of the juvenile and female is made up of three small joints tapering to a blunt end. It is held in an upright position above the abdomen. Cook in his description supposed this form to be a female or juvenile; Krayselin considers it a different species, but upon close study of the rest of the organs of this form it was finally decided that it was a juvenile and probably a female, the supposition being held that the juvenile took the form of the female, as is often the case, until the last few molts. The epigynum of this form was extremely undeveloped, having only a small epigastic furrow with depressions at either end.

The caudal appendage of the supposed male is made up of two stout joints to which is attached a heart-shaped body tapering to a blunt apex. This body has deep pits both on the dorsal and ventral sides near the base.

On the tibia of the first pair of legs are two long special sensory hairs set in little pits. On the second, third and fourth legs one hair was found, also on the tibia. These hairs are three-fourths as long as the leg.

The mouth parts consist of a pair of strong mandibles and labium. The labium is placed between the two coxæ of the maxillæ.

The long process of the coxa clothed with its long simple hairs seems to have some performance in the work of the mouth parts. The labium is suboval, clothed thickly with simple short hairs, the upper margin having a single row of long heavy straight hairs with many long single curved hairs covering them.

The mandibles are provided with three distinct kinds of hairs or spines. The large subquadrate proximal joint was clothed with long barbed spines, the movable finger having on its median surface a row of fifteen back curved barbed spines. In the space between the movable and stationary finger were long hairs, enlarged in the center and tapering off to a fine point, the tapered portion being barbed. The mandibles are set well down in the cephalothorax.

The sexual openings were found in the usual place; the ventral surface of the first abdominal segment, this being enlarged so as to do away with the second abdominal segment. The epigynum consists of a long epigastric furrow with a large lip-like opening near its median line. Just above this opening and on either side were small longitudinal creases.

Prof. Dr. Friedrich Dahl places the external sexual organs of this family on the legs and in the Thelyphonidæ which is closely related. They are found in the second joint of the tarsus of the first legs. Careful study failed to find any trace of secondary sexual organs in *Trithyreus pentapeltis*.

- | | |
|--|------|
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| Das Tierreich. Scorpiones und Pedipalpi. | |
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| Synopsis of North American Invertebrates. Am. Nat. Vol. 34. | |
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| Vergleichende Physiologie and Morphologie Der Spinnentiere.
Jena, Verlag N. G. Fischer. | |
| (Contribution from the Zoological Laboratory of Pomona College.) | |

EXPLANATION OF FIGURES

Fig. 1. Drawing of the upper side of a young *Trithyreus pentapelti* Cook X10.

Fig. 2. Lower or ventral view of *T. Pentapeltis* X10.

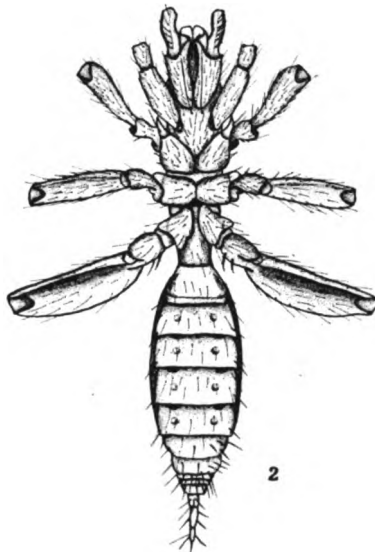
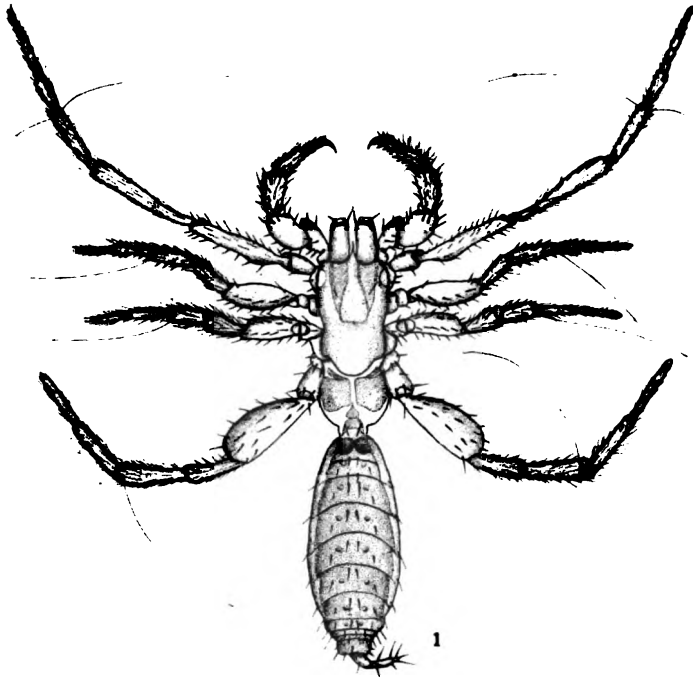
Figs. 3, 4, and 5. Various views of the caudal end of an adult *T. Pentapeltia*.
Much enlarged.

Fig. 6. Labium. Much enlarged.

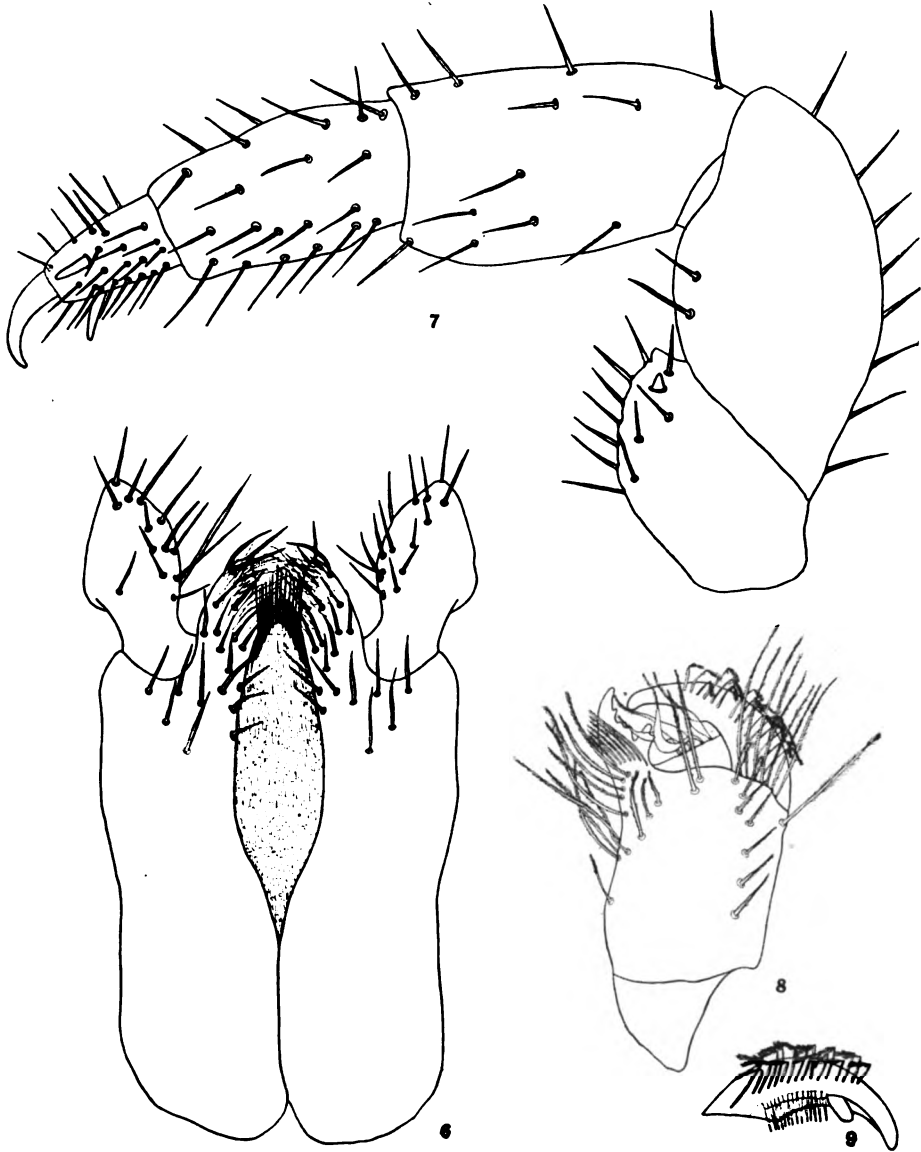
Fig. 7. Maxilla. Much enlarged.

Fig. 9. Mandible of *Trithyreus*. Much enlarged.

Fig. 9. One jaw of mandible. Much enlarged.







Notes on Chalcid Flies, Chiefly From California

A. A. GIRAULT

The following descriptions are chiefly from specimens sent by the Department of Zoology of Pomona College.

Eusandalum californicum n. sp.

Female: Similar in every respect to *coquillettii* Ashmead except as follows: The hyaline cross-stripe between the fuscous cross-stripes of the forewing is distinctly narrower than either fuscous cross-stripe (broader than either in the other); the stylus of the abdomen is a little shorter than the ovipositor valves (their extruded portion), both equal in length in *coquillettii*. Otherwise the same. Antennæ 11-jointed, tapering, the club single and no longer than the pedicel, funicle 1 quadrate, 2 longest, elongate, somewhat compressed, over thrice the length of the pedicel. Types compared.

A female from Claremont (C. F. Baker).

Types: Catalogue No. 20357, U. S. National Museum, the female on a tag, a fore wing antenna and hind leg on a slide.

In the U. S. National Museum a female from the Santa Cruz Mountains, California, part of the type of *coquillettii* (now a single female from Los Angeles).

Eusandalum obscurum n. sp.

The type is one female from Easton, Washington (Kincaid). Catalogue No. 20358, U. S. National Museum, the female on a tag. See table.

Eusandalum alpinum n. sp.

The type is a part of the type of *coquillettii* from the Santa Cruz Mountains, California; Catalogue No. 20359, U. S. National Museum, the specimen on a tag. See table.

Eusandalum georgia n. sp.

One female, pinned, Georgia, Catalogue No. 20369, U. S. National Museum. A second female from Washington, D. C. See table.

Eusandalum arizona n. sp.

A female, Santa Rita Mountains, Arizona (Schwarz), May 27.
Catalogue No. 20361, U. S. National Museum, tag. See table.

Synopsis of the North American Species of *Eusandalum*.
Females. (From the types.)

1. Wings bifasciate, the distal fuscous band at apex. Legs red except the coxae, the antennae wholly concolorous. Ovipositor extruded for over half the length of the abdomen. Scutellum longitudinally lined.

Hyaline band of fore wing distinctly narrower than either fuscous band (one on each side of it); stylus a little shorter than the ovipositor. *californicum* Girault

Hyaline band of fore wing somewhat broader than either fuscous stripe; stylus and ovipositor equal.

coquilletii Ashmead

2. Wings unifasciate or wholly embrowned or with a large unbroken, fuscous area. Wings wholly infuscated. Scutellum densely punctate like the scutum (in the first species). Propodeum with a lateral sulcus.

Ovipositor much extruded.

Legs reddish except the coxae and the first and third femora *ventrad*; more slender than usual, the ovipositor about as in *californicum* but the abdomen is longer, hence the ovipositor is so. Fore wing with a longitudinal white streak caudad of middle. *acmaeoderae* Rohwer

Ovipositor extruded for less than a fourth the length of the abdomen, the stylus subobsolete.

Fore wings indefinitely slightly stained; legs reddish except the coxae; scutellum long-lineolated. *obscurum* Girault

Wings infuscated from the bend of the submarginal vein to apex or nearly. Antennae concolorous (compare *obscurum*).

As in *californicum* but the scutellum finely punctate; differs from *acmaeoderae* in being more robust, the first and third femora are not metallic *ventrad*, the costal cell is broader, the tip of the fore wing is hyaline for a short distance.

alpinum Girault

Legs wholly concolorous except the knees and tips of tibiae narrowly and the tarsi; as in the preceding but stylus and ovipositor subequal. *cyaneum* Ashmead

3. Wings hyaline or subhyaline. Antennæ concolorous except at extreme base.

Ovipositor extruded for about half the length of the abdomen, the stylus slightly short.

Middle legs except coxae, all knees narrowly, tips of tibiae and the tarsi reddish brown. Postmarginal vein subequal to the stigmal. *hubbardii* Ashmead

Ovipositor extruded for less (or not more) than a third the length of the abdomen, the stylus subequal.

Postmarginal vein subequal to the stigmal.

Legs reddish except the coxae and cephalic femora and tibiae. Scutellum somewhat more distinctly lineolated longitudinally, punctate. Ovipositor short. *hyalinipenne* Ashmead

Postmarginal vein distinctly longer than the stigmal.

Legs concolorous except knees, tips of tibiae and the tarsi. Stylus somewhat shorter than the ovipositor which is a third the length of the abdomen. *georgia* Girault

4. Wings subhyaline. Antennae with the basal fourth of the scape honey yellow.

Postmarginal vein distinctly much longer than the stigmal, twice longer.

Ovipositor extruded for nearly half the length of the abdomen, the stylus a little shorter. Legs honey yellow except fore and hind coxae. *arizona* Girault

All the species have the postmarginal vein shorter than the stigmal or no longer, save where noted; the parapsidal furrows are distinct, but very short, joining before the middle of the scutum from cephalad. The club is usually single, the antennae 11-jointed, tapering-filiform.

Dialinus begini Crawford

One female, Santa Clara County (C. F. Baker).

Elachistus coxalis Howard

One pair, San Mateo County, California, the male; and Laguna Beach, Southern California, the female (C. F. Baker).

The following species is an *Eudecatoma* (there being no distinct substigmal spot but only a very minute one) but for the present I include this segregate within the older one.

Decatoma subimmaculata n. sp.

Female: Length, 2.00 mm. Of the usual habitus and sculpture, the punctation not coarse.

Honey yellow, the wings hyaline, the following black markings: Ocellar dots obscurely, upper margin of occiput (a crescent), median channel nearly to apex and cephalic margin of the propodeum (except laterad); abdominal petiole and the median line of abdomen dorsad narrowly, from just before apex of segment 2 nearly to the apex of segment 4. Abdomen compressed, segments 2, 4 and 5 subequal, longest, the abdomen glabrous, its petiole about twice longer than wide. Propodeum openly rugoso-punctate, the median channel single, distinct, no median basin. Pedicel black above, nearly twice longer than wide, a little longer than funicle 1, the other four funicle joints subequal, subquadrate. Club 2-jointed, the first joint shortest.

One female, Claremont, California (C. F. Baker); on oak.

Type: Catalogue No. 20400, U. S. National Museum, the female on a tag, the antennae and a caudal leg on a slide.

Differs from *catesbaei* Ashmead (types compared), in being larger, the median channel of the propodeum is distinct for its whole length and does not consist principally of two large foreae, the cross-carina passing *profmad* of it has an area on each side of the meson which runs at first nearly parallel to the channel (the forking) but in the Florida species, this carina continues more or less parallel with the cephalic margin of the propodeum.

Scutellista cyanea Mots

One female, Claremont, California (C. F. Baker).

Cleonymus californicus n. sp.

Female: Length, 4.00 mm.

Dark metallic green, the tegulae, antennae (except the club and pedicel) and the legs (except the concolorous coxae, the apex of caudal femur lateral and the last two pairs of tibiae dorsad more or less), reddish brown, the venation fuscous, the fore wings bifasciate, the first stripe from the base of the marginal vein and broken distad of the middle, the second from the postmarginal vein, obovate in shape, twice the width of the first. The (triangular) head, the thorax and abdomen, scaly punctate, the propodeum and abdomen 2 subglabrous, the distal margins of the abdominal segments glabrous. Propodeum foreolate along the cephalic and caudal margins, and along the median carina on each side, the lateral carina represented by a distinct, curved, foreate sulcus, the spiracle large, subreniform. Scutellum simple. Antennae inserted near the clypeus, a little below the eyes, 11-jointed, the club pointed ovate, acuminate at apex, embraced by the long projection from one side of the apex of the distal funicle joint which reaches to distal three-fourths of the club. Funicles 1 and 2 narrowest, grading into 3, all subquadrate, 4 longest, a little longer than wide and subequal to the pedicel; 8 wider than long. Postmarginal vein a little longer than the slender, curved stigmal, about a third the length of the marginal. Stigmal vein parallel, in general trend, with the costal margin.

Two females, mountains near Claremont (C. F. Baker).

Types: Catalogue No. 20348, U. S. National Museum, the females on tags, a fore wing and an antennae on a slide.

The abdomen is subpetiolate; it was distinctly, quadrately petiolate in a male specimen of *cleonymus depressus* in the U. S. National Museum.

Entedon occidentalis Girault

Several specimens, Claremont, California (C. F. Baker).

Isosoma grande Riley

One winged female, mountains near Claremont, California (C. F. Baker).

Metapleura spectabilis Westwood

One female, Claremont, California (C. F. Baker).

The Rose Flea-Beetle

(*Haltica probata* Fall)

G. F. MOZNETTE,
ASSISTANT ENTOMOLOGIST, OREGON AGRICULTURAL COLLEGE,
CORVALLIS, OREGON

INTRODUCTION

From a careful perusal of the literature it is apparent that scarcely anything but the original description of *Haltica probata* Fall appears in print. As this species has at various times been reported on several of our cultivated plants, and as there is some possibility of its becoming destructive to our cultivated roses, observations have been made from time to time and this paper brings together, so far as possible, the recorded facts concerning the species.

HISTORY AND DISTRIBUTION OF THE SPECIES

The species was first described by Dr. H. C. Fall in 1910.* Mr. Arthur Gibson† mentions it as attacking leaves of strawberry plants at Nelson, British Columbia. The species is referred to as *Haltica evicta* Lec., but after a comparison with specimens in the writer's collection and later in Dr. Fall's collection at Pasadena, California, I am led to believe that the species reported by Mr. Gibson as *evicta* is not *evicta* but *probata*. It has been reported from Spokane, Washington, on strawberries, and at various times has been reported feeding on cultivated crops in Oregon.

The species is distributed along the Pacific Coast from British Columbia to California. It has been reported from Nelson in British Columbia; Everett and Spokane in Washington; from Corvallis, Pamela Lake, Mary's Peak, the Three Sisters, and Josephine County in Oregon; and from Santa Rosa, Belmont, Siskiyou, and Trinity Counties in California.

SEASONAL LIFE-HISTORY AND HABITS OF THE SPECIES

With the approach of warm weather in the spring, when the buds of the wild rose are showing their green, the little bronze

*Transactions of the American Entomological Society of America, Vol. 36, pp.

†Canadian Entomological Circular No. 2.
152-159.

beetles (Pl. I, Fig. 2) come from their winter quarters, about the middle of April or earlier depending on the spring weather conditions, and commence feeding on the tender small leaves of the expanding buds. The beetles possess a very brilliant lustre and when approached manifest a saltatorial habit, and may leap for a considerable distance. The insect passes the winter in the adult stage and during that time may be found concealed in convenient places. The writer has taken numerous individuals from beneath the moss of the scrub oak, which grows abundantly along the creeks in the Willamette Valley in Oregon. The first individuals were taken on April 11, 1913, feeding on a species of wild rose, *Rosa nukatana* Presl. near Corvallis, Oregon. The adults were at the time resting in the sun on the dried fruits of the rose and also on the moss which covered the oaks. In 1915, the first beetles were out on March 19 or somewhat earlier. Sometimes the March weather is too severe so that the beetles do not appear until later, and the inclement weather frequently puts a stop to the activity of the beetles and retards oviposition.

After emerging from their hibernating quarters, the beetles jump or fly to the nearest rose bush and soon begin to satisfy their appetite after the long winter's fast. At this time the tender bursting rose buds seem to be the favorite food, and the beetles engorge themselves with bites from the prospective crop of leaves, then locked up in the buds. The beetles seem to be most active during the warmer sunshiny portions of the day, when they may be seen jumping and flying about the rose bushes. When touched or jarred, they at once drop quickly to the ground, where they feign death for a short time, later returning to the foliage. Their shining bronze color renders it easy to discover and watch them at their destructive work. They begin gnawing an unsightly hole into either the side or top of the bursting leaf bud, often boring into the bud so far as to be almost hidden from view. It usually takes the beetles a few days to satisfy their vigorous spring appetites; then they turn their attention to the propagation of their kind. The later emerging adults feed voraciously on the foliage (Pl. I, Fig. 5) eating out irregular places in the leaves.

Many individuals were found in copulo on April 12, 1913, and on April 14, 1915. Eggs were laid in great numbers April 15, 1913, but not until the first of May in 1915, due to a long stretch of cold wet weather. By May 18 many eggs were to be found but usually no larvae. The eggs are laid in masses (Pl. I, Fig. 3) of from two to fifteen in a cluster with an average of between seven and nine. They are deposited usually on the lower surface of the leaf. No eggs are deposited until the foliage is well along usually, as this is the food of the larvae. The writer observed a female during oviposition. She thrusts out the egg and by a mucilagenous substance causes the egg to adhere fast to the leaf. She decorates the egg, as it were, with a fluid which later turns black and appears as a streak across the ova. The adults do not live long after egg deposition, usually about a week and a half. A number of females were observed to lay from forty to fifty eggs each.

The length of the egg stage was found to vary considerably even in the insectary, due no doubt largely to the weather conditions. In indoor observations it ranged from seven to fifteen days, with an average of twelve. In the open, eggs under screen cloth were deposited on May 24, 1913, and hatched June 10, 1913, a duration of seventeen days. By June, 1913, practically all of the egg masses had hatched and scarcely an adult could be found anywhere. The larvae are at first yellow, changing over to a black after a short period of time (Pl. I, Fig. 7). The eggs split at the side when the young emerge and the larvae remain quiet for some time apparently feeding first on the remaining egg juices. After a while they begin to move about for convenient feeding spots. The larvae moult three times, and after each moulting appear yellow, soon changing to a black. Several of the grubs usually work on the same leaf, continuing to eat small irregular holes, through, or nearly through, the leaf until it appears skeletonized (Pl. I, Fig. 7), when they seek new pastures.

When full grown the larvae drop to the soil and after burrowing to a depth of about an inch or less, they construct soil cells of earth (Pl. I, Fig. 6), not unlike the cell of the common cherry and pear slug, in which they pupate. By July 3, 1913, many larvae were

falling to the soil. The length of the larval stage varies from fifteen to twenty-five days with an average of twenty days. By July 10 many pupae (Pl. I, Fig. 4) were found in the soil. The writer neglected to ascertain the exact length of the pupal stage, but from the meager observations made up to this time ventures the opinion that it is about eighteen days. By the first of August many adults could be found. They are a beautiful metallic color when just emerged. The writer bred from the adults a species of Diptera a *Tachinid* but has not been able to ascertain the species. Subsequent observation revealed no eggs, so undoubtedly the species is single brooded. The life-cycle is calculated to last about fifty-five days from eggs to adults, but this is greatly influenced by the weather conditions. The length of the adult stage is about ten months, depending, of course, upon the time the warm days approach in the spring and upon the cold stretches which intervene, conditions which influence emergence from their hibernating quarters.

DESCRIPTION OF THE VARIOUS STAGES

The Eggs (Pl. I, Fig. 3) are of an orange color, oblong oval or bean-shaped. The egg has a delicate covering by which it is attached to the leaf. Nearly every egg has a sort of spine-shape structure attached, although it is not exactly a spine but a part of the egg covering, which, when it has dried, gives it a black streaked appearance at that point. The egg measures 1 mm. in length by .25 mm. in width.

The Larvae (Pl. I, Fig. 7) when full grown have the body wider at the anterior end, tapering gradually to the anal segment and covered with many hairs. They are covered with an oily substance in which they often collect their excrement as they feed and travel. The entire larva is black and the segments of the body possess numerous tubercles bearing setae. Each segment of the abdomen has a group of tubercles on a side above the spiracles. When full grown the larvae measure from 6 to 8 mm. in length.

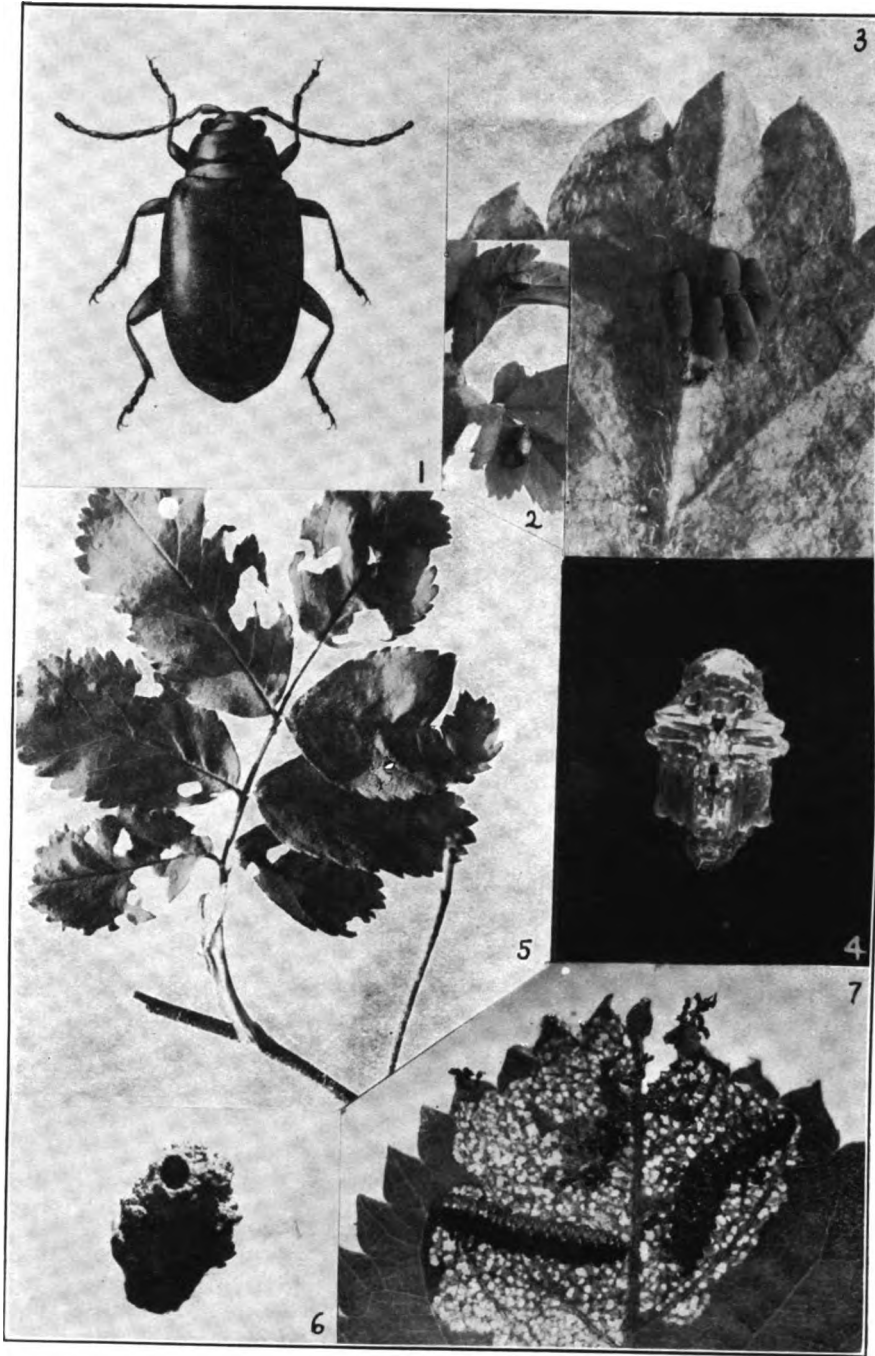
The Pupa (Pl. I, Fig. 4) is yellow, 4 to 6 mm. in length, with the wing pads and legs of a paler yellow to nearly white. Two setae are located on the vertex and two on the occiput of head. The

prothorax, mesothorax, and metathorax bear spines varying in number. The abdomen possesses three rows of setae on each side above the spiracles.

The Adult (Pl. I, Fig. 1) is green bronze, entire upper surface polished and strongly shining sculpture throughout, nearly as in *Haltica ignita*. Antennae piceous, slightly more than half the length of the body, joints 2-3-4 gradually increasing in length, the fourth very nearly three times as long as wide. Eyes rather small and not very prominent, their width as seen from the front distinctly less than half the interocular distance. Prothorax two-thirds wider than long, sides parallel in basal half, convergent anteriorly. Elytra fully two-thirds as wide as long, and nearly three-fourths wider than the prothorax. Body beneath piceous; abdomen alutaceous, rather coarsely punctate and transversely rugulose. Length 3.7 mm. to 4 mm.

EXPLANATION OF PLATE

- Figure 1.** The adult beetle (greatly enlarged).
- Figure 2.** The adult beetle (natural size).
- Figure 3.** Eggs in situ on leaf greatly enlarged.
- Figure 4.** Pupa greatly enlarged.
- Figure 5.** Rose leaves showing work of adult beetles.
- Figure 6.** Pupal soil cell.
- Figure 7.** Larvæ at work skeletonizing leaf.



Notes on Birds of Laguna Beach and Vicinity for 1916

H. H. NININGER

In addition to the work done by Mr. Leon Gardener and others on the distribution of birds in the vicinity of Laguna Beach I noted the following species in the summer of 1916:

70. *Sterna hirundo* (Common Tern)

This species was found occasionally about the muddy flats at Balboa.

74. *Sterna antillarum* (Least Tern)

The Least Tern is much more common than the former. They were often seen in small flocks diving for fish along the coast from Laguna to Balboa. They probably nest along the sandy shores; but none of their nests were taken by the writer.

95. *Puffinis griseus* (Dark Bodied Shearwater)

These birds were found ten to twelve miles from shore, in flocks feeding over schools of fish. They are called by the fishermen "Barracuda Birds."

210. *Rollus obsoletus* (Calif. Clapper Rail)

Found in the swampy tracts about Balboa.

214. *Porzana carolina* (Sora Rail)

A specimen of this Rail was taken at one of the lakes in Laguna Canyon in the latter part of July.

421. *Chordeiles acutipennis* (Texas Night Hawk)

Either at dusk or at dawn these birds could be found abundantly, in certain localities, feeding over fields, pools and streams to which they came at dusk, from the hills where they spent the daylight hours. Mr. C. C. White found a pair of young almost ready for flight on one of the hills bordering on Laguna Canyon, July 7, 1916.

425. *Aeronautes melanoleucus* (White-throated Swift)

Mr. Charles A. Keeler in "Bird Notes Afield" (1889) records this species from Capistrano. To one accustomed to meeting with

this bird only among the high and almost inaccessible cliffs of the mountains it is no little surprise to find it in a district so nearly level as the region about this old mission settlement. But surely it is there. A visit to the place in the latter part of July revealed the fact that they are, seventeen years since Mr. Keeler's writings, still using the same broken walls as a retreat. I think they are nesting at the time we visited the place, for upon the entrance of an adult into one of the crevices there came cries of young birds which seemed to be coming from birds that were being fed.

530a. *Astragalinus P. hesperophilus* (Green-backed Goldfinch)

Common around Laguna and the neighboring hills. Nests with eggs were found, probably the second brood for the season.

634. *Vireo vicinior* (Gray Vireo)

Found along the streams near Capistrano.

685a. *Wilsonia pusilla pileolata* (Pileolated Warbler)

Fairly common in trees along streams near Capistrano.

364. *Pandion haliaetus carolinensis* (American Osprey)

One of these magnificent birds was found on the rocky cliffs bordering the shore between Laguna and Balboa. It was seen several times and was reasonably tame.

BREEDING NOTES

In addition to the nests of the more common birds the following were noted:

Several Raven nests on the cliffs bordering the shore and are in Boat Canyon about a mile from the sea were found deserted, but feathers of their owners and the remains of their food betrayed their identity.

A brood of Ruddy Ducks was seen on one of the lakes in Laguna Canyon several times.

Coots were found breeding about the lakes in abundance.

(Contribution from the Zoological Laboratory of Pomona College)

Solpugids From the Claremont-Laguna Region

J. NISBET

The following list of solpugids represents a collection obtained by students and others during the past four or five years. Drawings are given of one large specimen and top and side views of the head region of several others. The determinations are by Dr. N. Banks.

Eremobates formicaria Koch

This species has been taken from our region although such large specimens have been reported only from dryer regions. This specimen, a male is from Brawley, Cal. (Figs. 1 and 2). Figs. 3 and 4 were taken from a young specimen collected at Claremont.

The movable finger of the chelicerae of the male has two large teeth. Anterior margin of rephalothorix straight. Hind tarsi one segment.

Eremobates californica Sim.

The drawing are from a specimen taken at Laguna Beach (Figs. 5 and 6). Specimens were also taken at Claremont. Movable finger of the chelicerae with a large tooth. This is not so marked in the female. Hind tarsi one segment.

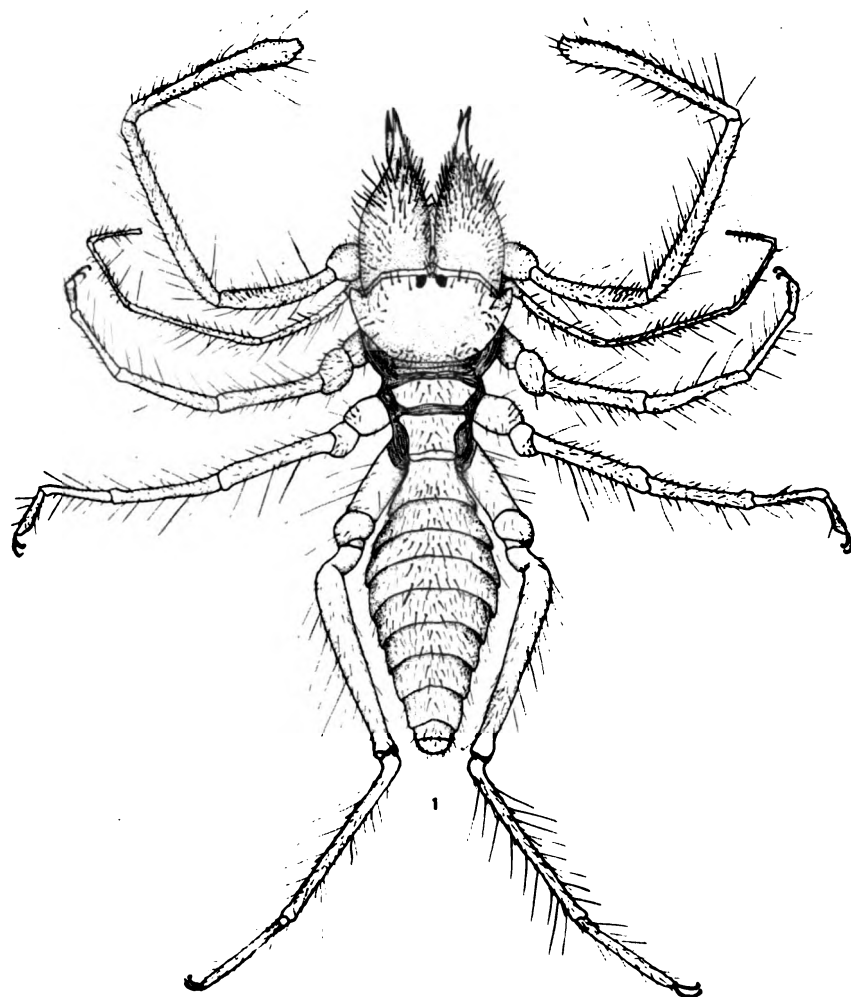
Hemerotrecha californica Banks

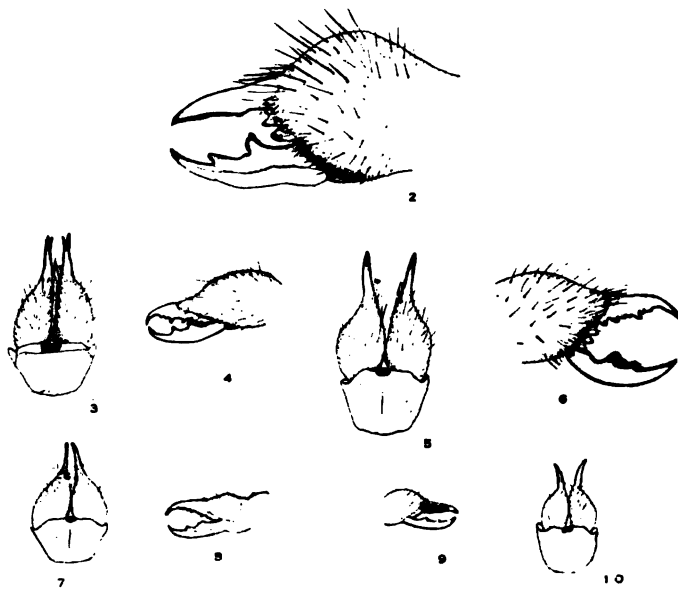
Specimens were obtained at Claremont. Upper finger of chelicerae without teeth or many small teeth. Male has an elongated flayellow of two parts on the upper finger of chalicera. Hind tarsi with three joints. Specimens obtained were about evenly divided between this and the previous species (Figs. 7, 8, 9 and 10).

(Contribution from the Zoological Laboratory of Pomona College)

EXPLANATION OF FIGURES

- Figure 1. *Eremobates formicaria* Koch. X2.
Figure 2. *Eremobates formicaria* Koch, side view of chelicera. X2.
Figures 3-4. Chelicerae from young *E. formicaria*. X2.
Figures 5-6. Chelicerae from *E. californica* Sim. X2.
Figures 7-8. Chelicerae from *Hemerotrecha californica* Banks, views of the chelicerae. X2.
Figures 9-10. *H. californica* views of chelicerae, another specimen. X2.





Record of Two Pseudoscorpions From Claremont-Laguna Region

WINIFRED T. MOORE

Garypus Californicus Banks.

Description: Fig. 1. Length 5 mm.,

Color: Cephalothorax and pedipalps dark brown, abdomen and legs light yellow; each abdominal scutae with a dark central spot; anterior ventral scutae also with dark spots. Cephalothorax emarginate; four eyes; femur of pedipalps longer than cephalothorax, tibia hardly convex on inner side, hand about as long as tibia, fingers longer than hand; legs long and slender.

Habitat: Specimen found under rocks near ocean at Laguna Beach, collected by Walter Sturgis.

Chelanops pallipes Banks

Description: Fig. 2. Length 2 mm. including mandibles.

Color: Cephalothorax light reddish brown, pedipalps darker, abdomen and legs pale yellow.

Similar to *C. dorsalis*, but fingers a little longer than hand; no eye spots, clavate hairs found on all parts of two types, on legs and pedipalps more clavate on one side (Fig. 3) on body evening clavate (Fig. 4). Simple hairs found on under surface of tarsus. All parts covered with small chiton plates.

Habitat: Specimens taken from under stones in wash near Claremont.

(Contribution from the Zoological Laboratory of Pomona College)

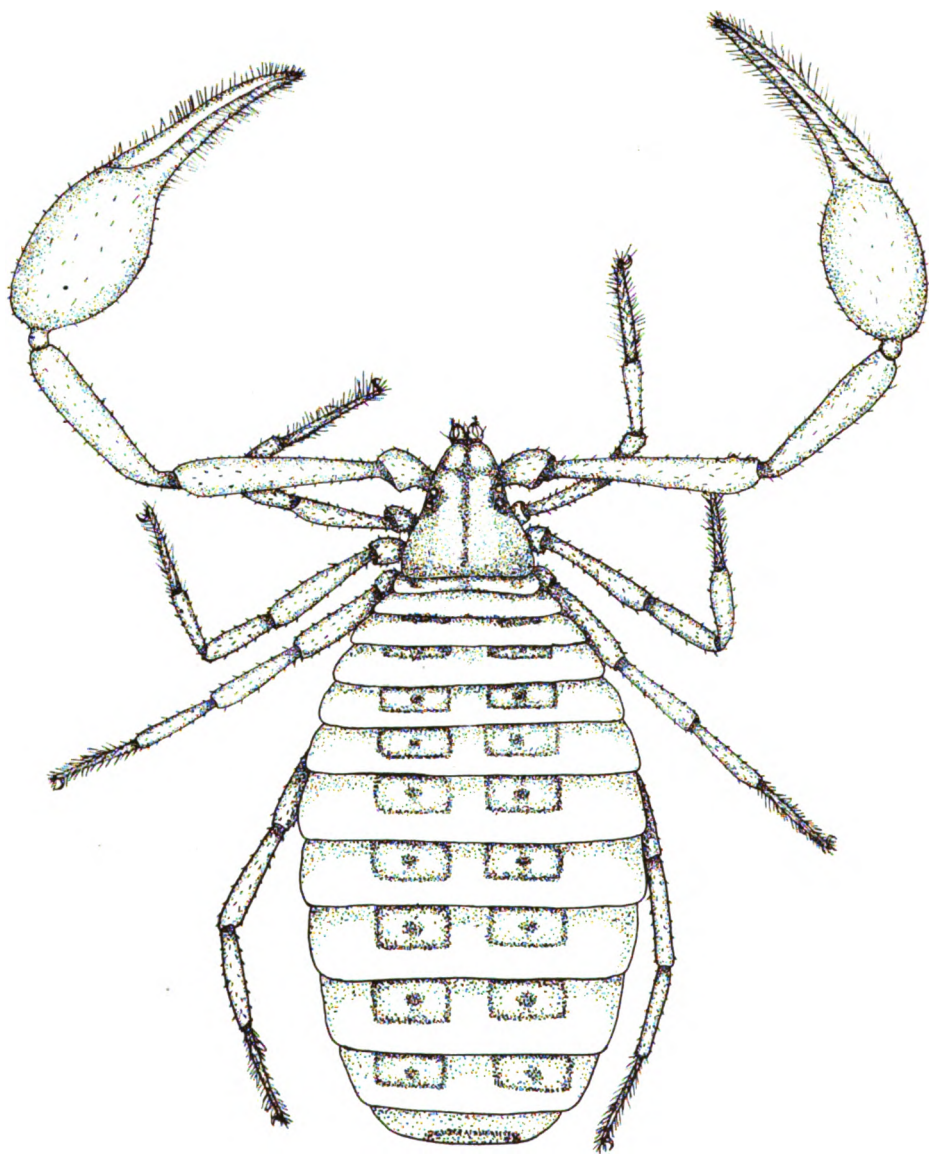
EXPLANATION OF FIGURES

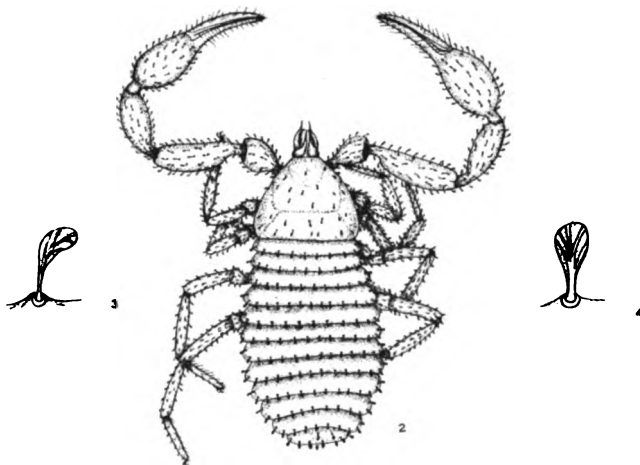
Figure 1. *Garypus Californicus*. X20.

Figure 2. *Chelanops pallipes*. X20.

Figure 3. Hair from legs and pedipalps of *C. pallipes* much enlarged.

Figure 4. Hair from body of *C. pallipes* much enlarged.





The Central Nervous System of a Sipunculid

WILLIAM A. HILTON

A number of specimens of the genus *Phascolosoma* were obtained at Laguna Beach. These were preserved in various fluids. Flemming's fluid and mercuric chloride, were especially valuable for study. The nerve cords were dissected out and mounted after staining. Some were imbedded, sectioned and stained. The stain which brought out the cells with greatest clearness was copper haematoxylin.

The general character of the nervous system of sipunculids is well known, and the specimens examined at this time were typical as to the form of the brain and cord. The brain is imbedded in the proboscis just below the tentacles. It has a similar appearance in section to the photographs of Spengel, 1912. The brain is small. Two main branches supply nearby tentacles and muscles. There is a pair of small branches from the connectives. Extending from the epithelium of the tentacular region is a pair of tubes leading into the brain, the cerebral organs. These epithelial tubes lead to a pigmented area on each side, and these pigmented areas in section look like simple eyes. A few irregular spots of pigment were found near the larger masses. The epithelium at the outer end of the tube was also deeply pigmented.

Throughout the body the ventral nerve cord kept about the same width, although the muscle bands at the sides increased somewhat. The strands connecting the muscles and nerves to the animal's body were more or less regularly arranged. In specimens with the proboscis drawn in, the nerve cord is of course doubled back on itself. In the specimen drawn at the junction of the two parts, that of the proboscis and that of the ventral body-wall, there is a lack of lateral branches, as shown in the upper portion of the second line of the drawing. Towards the caudal end the lateral branches come off more irregularly.

When the animal is contracted the nerve cord seems to be segmented, but sections show that this appearance is due to the slight

folding of the nerve cord within the muscle bands; the nerve tissue does not seem to be elastic.

Very little has been written on the histological structure of sipunculids. Haller, 1889, discusses a number of points, especially in *sipunculus nudus*, relating to the ventral cord only. I find a number of differences in this form. I did not find any very clear evidence of special neuroglia cells, such as described and figured by Haller, such elements may be present, but at least they are not evident, not so evident as in many other invertebrates which I have examined. Nerve cells may anastomose with each other as shown in Haller's figure, but of this I can not be sure. If fibres do not unite they are in very intimate contact.

In the ventral cord no small fibrils were seen only rather small fibers which may have been fibrils. The lack of connective material in part at least, perhaps because the nervous system is often extended and folded, shows the cell processes with great distinctness. This may be why a clearer picture than usual is presented of the relationship of cells.

Cells are abundant on the ventral side of the cord, especially in the middle line. The more dorsal fibrous region is practically without cells of any kind. No very marked tracts of fibers are evident, the fibers are about equally distributed in all directions and may be subdivided as follows:

1. Fibers which enter the fibrous mass from cells and run short distances up and down.
2. Fibers which pass from cells to other cells near by in the cellular area.
3. Fibers which leave the ganglion laterally from ventral cells.
4. Fibers which enter from the lateral nerves to end in the fiber area or in among the cells.

There are no indications of long fibers, either ascending or descending. After the examination of the cord of this animal one is impressed with the suggestion that many cells of similar sort act alike, that is groups of cells, not individuals are involved in the simplest transmissions of impulses. This general suggestion which, of course, is not new, comes to mind with great clearness after the

study of thin sections of the cord of this animal. Whether the cells actually anastomose or not is a questions hard to decide, but in the numerous contacts of naked fibers there is, I believe, ample opportunity for the transmission of complex changes from cell to cell, to all parts of the nervous system. In this form there is no particular localization of definite centers.

The brain differs in structure from the cord, the central fibrous mass is more dense, the cells are very much smaller and more numerous. Some cells of the brain send their fibers out directly without the common pathway of a distinct nerve trunk. No special features of the brain were determined except the cerebral organs already described.

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(Contribution from the Zoological Laboratory of Pomona College)

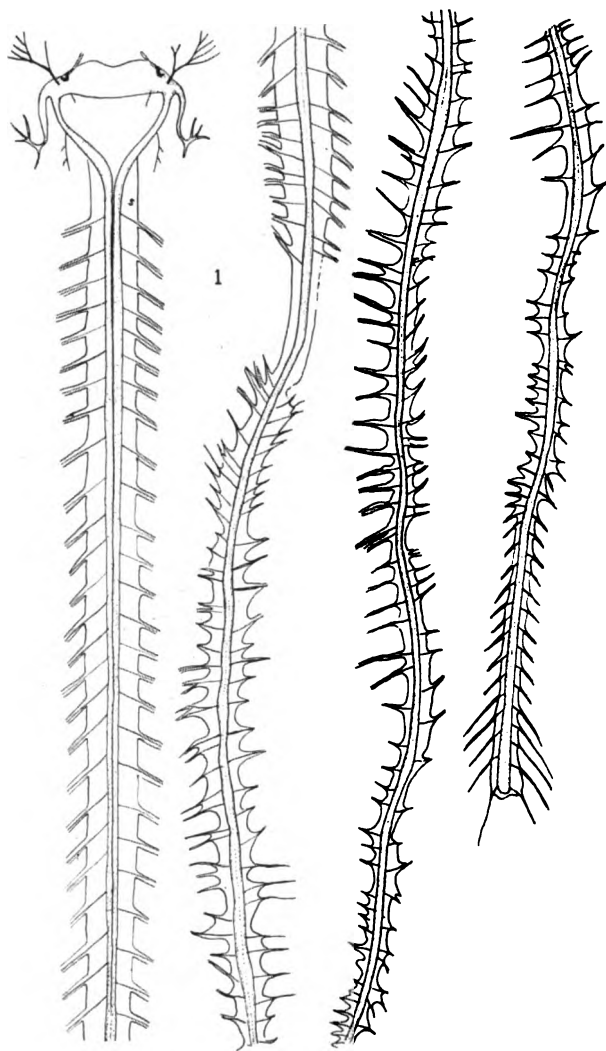
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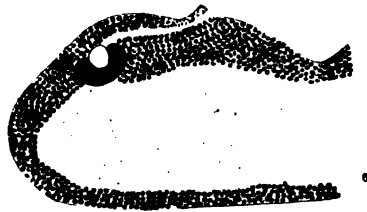
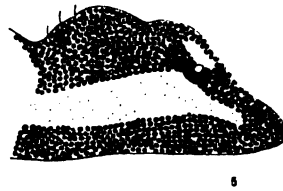
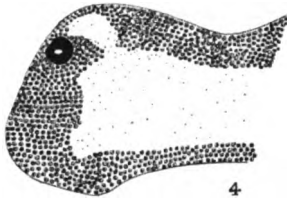
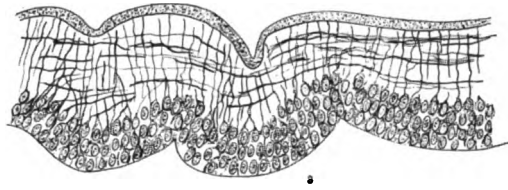
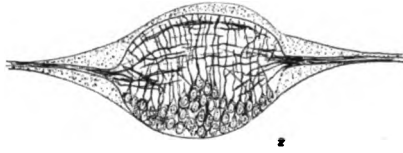
Figure 1. Central nervous system of *Phascolosoma* X15. The cord is shown in three separate pieces. The lower end of the first or left-hand drawing should join with the second and so on. The central nerve band is shown with the lateral branches of muscle and nerve. The brain is shown attached to the first segment at the left. The pigment spots, cerebral tubes and chief nerves are shown. The brain is drawn from reconstructions made from serial sections.

Figure 2. Cross section of the nerve cord. X75.

Figure 3. Longitudinal section of the nerve cord. X75.

Figures 4 to 6. Drawings of sections taken through the brain at various levels, only one-half is shown in each case. X75.





Littoral Ascidians Collected at Laguna Beach

The specimens reported upon are from a collection made by P. A. Lichti during the summer of 1915, and from a small collection brought in during the summer of 1916. The determinations of all but the fifth were kindly made by Prof. W. E. Ritter.

Ascidia californica Ritter and Forsythe

These simple forms were found quite abundantly under stones and in kelp holdfasts. The form of the body was determined largely by the position the animal took on the stone or seaweed.

Styela barnharti Ritter and Forsythe

The specimens obtained were young, simple, of a reddish-brown color and about 4 mm. high. They were found under stones at low tide but not as commonly as some others.

Styela montereyensis Dall

A single specimen of this large, simple species was taken just off shore. It was slender at the base, expanded near the openings and of a reddish-brown color.

Euherdmania claviformis Ritter

This slender species was often found in clusters under stones. They were about 2 mm. in diameter and 10-20 mm. long, sometimes free from sand, at other times covered with sand grains.

Goodsiria dura Ritter

Bright red or orange masses of these were often found in bits of seaweed from deeper water. The individuals were 2 to 3 mm. across and often closely massed on the seaweed or other support.

Eudistoma diaphanes Ritter and Forsythe

This was the common compound species found closely attached to the lower sides of stones. It was often quite extensive but not thick or colored.

Eudistoma psamion Ritter and Forsythe

Great masses of this tough, pinkish or slightly colored form were found under rock ledges. It resembles one of the sponges in

general appearance and is found in among sponges and polyzoans. This was one of the most bulky forms which we found.

Glossophorum planum Ritter and Forsythe

Irregular masses of this species were found under rock ledges and under stones. Our specimens are largely covered with sand grains.

Distaplia occidentalis Ritter and Forsythe

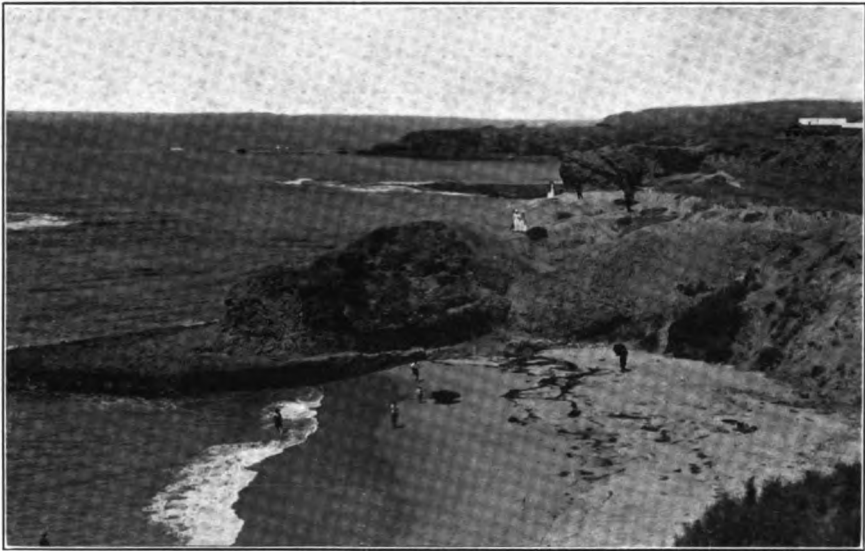
This compound stalked form was found on a rock ledge at low tide near Salt Creek.

W. A. H.

(Contribution from the Zoological Laboratory of Pomona College)

Summer School at Laguna Beach

The summer school at Laguna Beach during the past season was in many respects the most valuable of the past five or six years. There were more students, more teachers and fully as many visitors. The harvest of specimens was very satisfactory. Many creatures not before gathered here were brought from the near-by waters. *Amphioxus* was obtained here for the first time, as well as many other interesting and valuable specimens.



Several new courses were offered. A course in Ecology was given by Professor Bean. In this the local distribution of animals was especially studied. A similar course is to be offered this summer to those who have had some zoology. It is believed that this work will bring greater and greater advantages to us here as we come to know the local conditions better. In the nature of the material this will always be to a large extent a field study.

The course in birds given by Professor Nininger was interesting and valuable. A number of new records for this region were obtained during the summer.



For the first time Miss Hills gave a course in drawing in connection with zoological subjects. This much-needed and valuable work will be continued during the coming summer, not only in a special course, but also in an optional way in connection with several of the other courses.



In connection with the ecology especially, more off-shore collecting was done than ever before. A number of longer trips were found interesting and valuable. Laguna at all times offers attractive walks and many short trips were taken by all classes. Some of these were for a few miles along the coast, back in the hills or by water or land for a considerable distance.

The rocks and coves were again explored, yet much remains unknown. Many new specimens to the locality were found, some of these were from deeper water, rare fish, large sea cucumbers, a large number of strange crabs and many other smaller but no less interesting creatures.

As in the past, a number of workers from other institutions used the private laboratories. The eight research rooms were in use most of the time by those doing more advanced work. It is expected that there will be a number of advanced workers from the northern and eastern universities during the coming season. For the first time the laboratory is provided with a satisfactory lighting system. Electricity is now established at Laguna Beach and the laboratory and tent city are well provided with an ample lighting system.

The tent city and dining hall will again offer accommodations at reasonable prices. The cost of tuition is \$7.50 general charge and \$3.00 an hour per hour taken. By an hour is meant the equivalent of an hour's work in a regular college semester. There are eight private rooms for special investigators.

For further information write to the Director, William A. Hilton, Pomona College, Claremont, Cal. (Laguna Beach, Cal., from June 26 to September 20.)

Courses Offered at the Summer School of the Laguna Beach Biological Laboratory 1917

To reach Laguna Beach from Los Angeles take the electric or Santa Fe to Santa Ana. From Santa Ana a morning stage leaves at ten, an afternoon stage at four.

Work begins June 27 and regular courses last six weeks, but the laboratory is open all summer.

No one may register for more than six hours. By an hour is included the equivalent of an hour's work during a regular college semester.

The staff of the Laguna Marine Laboratory for the summer will be as follows, several others from eastern institutions may be added later.

William A. Hilton, Pomona College, Director *Zoology*

Dr. R. V. Chamberlin, Harvard University Museum of
Comparative Zoology *Zoology*

E. O. Essig, Department of Entomology University of
California *Entomology*

Anna A. Hills *Scientific Drawing*

1. S. B. 11. Zoology (2 hours). A synopsis of marine invertebrates. Lectures and class exercises with early morning field trips. Prerequisite Biology A1, or open to those who are taking some other biological work. M. to F. at 8.
- 1a. S. B. 11. Zoology. Marine invertebrates (1 hour if taken with 1, or 2 hours). Laboratory on typical local forms. Mornings 9 to 12, except Saturday.
2. S. B. 18. General Entomology (2 to 3 hours). Class laboratory and field work in the general study of local insects. Prerequisite Biology A1, or Zoology B11, or may be accompanied by one of these. Class period M. to F. at 11. Laboratory and field work at hours to be arranged.

3. S. A1. General Biology (3 hours). A beginning course dealing with general principles. Open to those who have had no biological work and who have either entered college or are about to enter. Class periods M. to F. at 11. Laboratory and field work afternoons.
4. S. C. 4. Ecology (2 or 3 hours). Class, field and laboratory work at hours to be arranged. A study of local land and aquatic societies and the factors governing the distribution of marine, fresh water and land forms. Prerequisite, a year of biological work. Class periods M. W. F. at 1.
5. S. C. 5. Nature Study (2 or 3 hours). Methods and materials for nature study. This will be given in the evening when a lantern may be used. A general view of the whole field will be given either for those who are teaching, those who intend to teach, or those who desire the general not technical information. This is not a course for college credit. M. to F. evening at 7:30. Laboratory and field work to be arranged. This will be given by a number of teachers.
7. S. D. 7. Mammalian Embryology (2 hours). Laboratory work with serial sections of embryos. Prerequisite two years of zoological work. A review course for those in the practice of medicine or preparing for medical work. Hours to be arranged.
8. S. D. 8. Neurology (2 or 3 hours). Laboratory work with sections of the human brain and cord. A review course open only to those who have some knowledge of the central nervous system of vertebrates. Especially designed for those who have interest in Neurology, Psychology or Medicine.

In addition to these courses special C. or D. work for 2 or 3 hours may be taken as follows:

- a. Special field and laboratory work with some group of marine animals, such as amphipods, isopods, decapods, gastropods, etc.
- b. Special field and laboratory work in Entomology, either with some single order or family, or life history work.

- c. Special field and laboratory work in the embryology of invertebrates.
- d. Special field and laboratory work in Ecology. Hours to be arranged.
- e. Special field and laboratory work in marine algæ. Hours to be arranged.

The following work in art will be offered by Miss Anna A. Hills:

- 1. S. A1. Art (2 hours) zoological drawing. A beginning course for students of Biology with marine and land specimens as material. This course will be an aid to any who may wish to prepare illustrations for scientific papers or books. Pen and ink, pencil and colored methods will be given. Tuition the same as in other courses. Students furnish their own drawing materials.
- 2. Outdoor sketch class with either water colors or oils—oils preferred.
- 3. Outdoor figure work. Especially arranged for if desired by those who have done out-of-door work.

Rates for two and three, 75 cents per hour. Each should be taken in three periods of three hours each.

Miss Hills has had the following preparation: Student in Olivet College, Art Institute, Chicago; Graduate of Cooper Union, New York City; special work under Rhoda Holmes Nicholls and Arthur W. Dow, New York. During four years study in Europe worked under Wilhelmina H. de Koning in Holland, Jean Paul Laurens and William Lappara in Julian's Academy, Paris, and in England two years out of doors under J. Noble Barlow.

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This journal is especially offered in exchange for zoological and entomological journals, proceedings, transactions, reports of societies, museums, laboratories and expeditions.

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THE JOURNAL OF ENTOMOLOGY AND ZOOLOGY

William A. Hilton, Editor

Claremont, California, U. S. A.

Preliminary List of Birds From the Claremont-Laguna Region

This list is compiled from many local sources. The earliest records of the Department of Zoology of Pomona College were by Illingsworth, later by Chas. Metz, by Leon L. Gardner and others. There is also included the local records of Wright M. Pierce, and Halsted White. The drawings are all from bird skins from the collections of Pierce and White and from the Department of Zoology of Pomona College. The drawings are by Miss Hazel Burnham. For criticisms, suggestions and much valuable material we have especially to thank Mr. Halsted White and Mr. Wright M. Pierce. Grinnell's "Distributional List of the Birds of California," was used as a basis in the use of the names.

In the list the initials after a record or statement denotes the authorship. Unless otherwise indicated the specimens drawn were males.

The figures on the last two plates are reduced one-half. Other figures are reduced one-third, the figures of the pelicans, condor and vulture are reduced more.

Aechmophorus occidentalis Law. Western Grebe. H.W.

Colymbus nigricollis californicus Heerm. American Eared Grebe. H.W. Seen occasionally in winter on ponds near Santa Ana river near Corona. W.M.P. Pl. I. Fig. 1.

Podilymbus podiceps Linn. Pie-billed Grebe. H.W. Seen at times near fresh water ponds at Corona. W.M.P. Pl. I. Fig. 2.

Gavia immer Brun. Balboa. L.L.G. Common Loon.

Gavia pacifica Lawr. Laguna Beach. L.L.G. Pacific Loon.

Ptychoramphus aleuticus Pall. Cassin Auklet. H.W.. Pl. I. Fig. 3.

Uria troille californica H. Bry. California Murre. One taken in winter at Newport Beach by A. Van Rossen. W.M.P.

Larus glaucescens Naum. Glaucous-winged Gull. Seen. H.W.

Larus occidentalis Aud. Western Gull. Laguna, Balboa. H.W. and L.L.G. Noted at all seasons along the coast, most commonly in fall and winter. W.M.P. Pl. I. Fig. 4.

Larus delawarensis Ord. Ring-billed Gull. Metz and H.W. Pl. I. Fig. 6.

Larus heermanni Cassin. Heermann Gull. Balboa. L.L.G. Pl. I. Fig. 5.

Larus philadelphia Ord. Bonaparte Gull. H.W. Pl. I. Fig. 7. Noted in flocks in spring, Nigger Slough, Los Angeles county. W.M.P.

Sterna paradisæa Brun. Arctic Tern. Near Laguna Beach, May 1, 1915. H.W. Pl. I. Fig. 8.

Sterna antillarum Less. Least Tern. H.W. Laguna Beach. L.L.G. Breeding on beach near Newport, June, 1916. W.M.P. Pl. I. Fig. 9.

Hydrochelidon nigra surinamensis Gmel. Black Tern. H.W. One taken on fresh water pond near Corona, May 18, 1915. W.M.P. Pl. I. Fig. 10.

Puffinus griseus Gmel. Dark-bodied Shearwater. Ten or twelve miles from shore near Laguna Beach, in flocks over schools of fish. H.H.N.

Phalacrocorax auritus albociliatus Ridg. Farallon Cormorant. Seen H.W. Pomona Davenport. Found at all times on reservoirs near Claremont; also seen in fall and winter on fresh water ponds near Corona. W.M.P. Pl. I. Fig. 11.

Pelecanus erythrorhynchos Gmel. White Pelican. Often seen on migrations. H. W., W.M.P., L.L.G. Pl. I. Fig. 13.

Pelecanus californicus Ridg. California Brown Pelican. Often seen at Laguna Beach. Pl. I. Fig. 12.

Mergus serrator Linn. Red-breasted Merganser. Balboa. H.W. L.L.G. Pl. I. Fig. 14.

Lophodytes cucullatus Linn. Hooded Merganser. Specimen, no record. Pl. I. Fig. 15.

Anas platyrhynchos Linn. Mallard. H.W. Fairly common in fall and winter, lowlands near Corona and Santa Ana river. Many specimens taken. A few pairs possibly remain and breed in the same region. W.M.P. Pl. II. Fig. 1.

Chaulelasmus streperus Linn. Gadwall. Seen H.W. Rather rare visitant to fresh water ponds near Corona. W.M.P.

Mareca americana Gmel. Baldpate. H.W. Rather abundant, certain winters, fresh water ponds near Corona, often in large flocks. W.M.P. Pl. II. Fig. 2.

Nettion carolinense Gmel. Green-winged Teal. H.W. Abundant some years, November to March. Always common. Pl. II. Fig. 3.

Querquedula cyanoptera Vieil. Cinnamon Teal. Laguna Beach. L.L.G., H.W. Fairly abundant early fall, less common in mid-winter. Scattering pairs breed in marshes near Corona. W.M.P. Pl. II. Fig. 4.

Spatula clypeata Linn. Shoveller. H.W. Abundant, fall and winter Santa Ana river and ponds. W.M.P. Pl. II. Fig. 5.

Dafila acuta Linn. Pintail. H.W. Very abundant from Oct. 15 to Dec. 1, or later. Large flocks seen in spring, Corona, Santa Ana river. W.M.P. Pl. II. Fig. 6.

Marila americana Eyt. Redhead. H.W. Occasionally taken on fresh water ponds near Corona. W.M.P. Pl. II. Fig. 7.

Marila valisineria Wil. Canvas-back. H.W. Occasionally taken on ponds near Corona. W.M.P. Pl. II. Fig. 8.

Marila marila Linn. Greater Scaup Duck. H.W. Pl. II. Fig. 9.

Marila collaris Donovan. Ring-necked Duck. One taken Dec. 12, 1915, fresh water pond near Corona. (Recorded in Condor.) W.M.P.

Charitonetta albeola Linn. Buffle-head. Seen H.W. Rare, seen once on pond near Corona. W.M.P. Pl. II. Fig. 10.

Oidemia deglandi Bonap. White-winged Scoter. H.W. Pl. II. Fig. 11.

Erismatura jamaicensis Gmel. Ruddy Duck. Laguna Beach Gardner. H.W. Common in small flocks, pairs or individuals, fall and winter, fresh water ponds near Corona. W.M.P. Pl. II. Fig. 12.

Dendrocygna bicolor Vieil. Fulvous Tree Duck. Claremont, June 30, 1897. Illingsworth. Pl. II. Fig. 13.

Plegadis guarauna Linn. White-faced Glossy Ibis. Rather uncommon. In Oct., 1916, two birds seen on fresh water ponds near Corona. W.M.P.

Botaurus lentiginosus Montag. American Bittern. H.W. Common in marsh and lowland near Corona, Chino, El Monte. Seen as late as April. Probably nests. W.M.P. Pl. II. Fig. 14.

Ardea herodias hyperonca Oberh. California Great Blue Heron. H.W. Laguna Beach. L.L.G. Breeding colony near Laguna Beach, April 23, 1917, eight or ten nests with young one-fourth to one-half grown. One nest with two eggs. Often seen near Corona and Chino standing in barley or beet fields. W.M.P. Pl. II. Fig. 15.

Butorides virescens anthonyi Mear. Anthony Green Herron. H.W. Several seen in San Dimas Canyon in early spring; also seen near Corona in river bottoms. W.M.P. Pl. II. Fig. 16.

Nycticorax nycticorax naevius Bodd. Black-crowned Night Heron. H.W. Claremont. L.L.G. In spring in Santa Ana river bottoms near Corona. W.M.P. Pl. II. Fig. 17.

Rallus obsoletus Ridg. California Clapper Rail. In swampy tracts about Balboa. H.H.N.

Rallus virginianus Linn. Virginia Rail. H.W. Many records, fall, winter, spring, near Chino and Corona. W.M.P. Pl. III. Fig. 1.

Porzana carolina Linn. Sora Rail. H.W. Same records as Virginia Rail. W.M.P. Pl. III. Fig. 2.

Coturnicops noveboracensis Gmel. Yellow Rail. One record, Corona. Pierce Condor XVI, 1914. W.M.P.

Gallinula galeata Licht. Florida Gallinule. Corona. H.W. Seen at times in fall near Corona. W.M.P. Pl. III. Fig. 3.

Fulica americana Gmel. Coot. H.W. Laguna Lakes. L.L.G. Very abundant near Corona. Breeds. W.M.P. Pl. III. Fig. 4.

Phalaropus fulicarius Linn. Red Phalarope. One record from near Corona. W.M.P.

Steganopus tricolor Vieil. Wilson Phalarope. H.W. Three records from fresh water ponds near Corona. W.M.P. Pl. III. Fig. 5.

Himantopus mexicanus Mull. Black-necked Stilt. H.W. Several in spring on fresh water ponds near Corona. W.M.P. Pl. III. Fig. 6.

Gallinago delicata Ord. Wilson Snipe. H.W. Common in fall and winter and spring, in wet fields near Corona and Chino. W.M.P. Pl. III. Fig. 7.

Macrorhamphus griseus scolopaceus Say. Long-billed Dowitcher. Balboa. L.L.G. Pl. III. Fig. 8.

Pisobia minutilla Vieil. Least Sandpiper. Long Beach. Metz. Flocks of twelve or fifteen seen at times on ponds near Corona. W.M.P. Pl. III. Fig. 9.

Ereunetes mauri Cab. Western Sandpiper. H.W. Long Beach. Metz. Pl. III. Fig. 10, female.

Calidris leucophaea Pall. Sanderling. H.W. Pl. III. Fig. 12.

Totanus melanoleucus Gmel. Greater Yellow-legs. H.W. Pl. III. Fig. 13. Corona ponds, fall and winter. W.M.P.

Catoptrophorus semipalmatus inornatus Brew. Western Willet. H.W. Pl. III. Fig. 14.

Heteractitis incanus Gmel. Wandering Tattler. Taken near Laguna Beach by H.W.

Actitis macularius Linn. Spotted Sandpiper. H.W. Fall, winter, spring; rocky coves near Laguna Beach. W.M.P. Pl. III. Fig. 11.

Numenius americanus Bech. Long-billed Curlew. H.W. Seen at Balboa in spring. W.M.P. Pl. III. Fig. 17.

Numenius hudsonicus Lath. Hudsonian Curlew. H.W. Balboa. L.L.G. Fall, winter, spring, Balboa, Newport, Laguna. W.M.P. Pl. III. Fig. 16.

Squatarola squatarola Linn. Black-bellied Plover. H.W. Same localities as last, not so abundant in winter. W.M.P. Pl. III. Fig. 18.

Oxyechus vociferus vociferus Linn. Killdeer. H.W. Laguna Gardner. Near Claremont, fall; Chino, Corona, Newport. Breed near Chino, Newport. W.M.P. Pl. III. Fig. 19.

Aegialitis semipalmata Bonap. Semipalmated Plover. Balboa. L.L.G.

Aegialitis nivosa Cass. Snowy Plover. H.W. Long Beach. Metz. Several pairs near Newport, 1916. Near Balboa at all seasons. W.M.P. Pl. III. Fig. 20.

Arenaria melanocephala Vig. Black Turnstone. H.W. Several records near Laguna. W.M.P. Pl. III. Fig. 21.

Oreortyx picta plumifera Goul. Mountain Quail. H.W. Recorded from Brown's Flats, San Antonio Canyon, Camp Baldy, Bear Flats, Palmers Canyon. W.M.P. Pl. III. Fig. 23.

Lophortyx californica vallicola Ridg. Valley Quail. H.W. Claremont, Santa Ana, Laguna, Lytle Creek up to 5000 ft. Breeds in April, 10 to 24 eggs. W.M.P. Pl. III. Fig. 22.

Columba fasciata fasciata Say. Band-tailed Pigeon. Oct. 1916. H.W. Claremont. Metz. Abundant in San Dimas Canyon at certain seasons, usually in large flocks, less common than formerly. Found at Glen Ranch in Lytle Creek. W.M.P. Pl. III. Fig. 25.

Zenaidura macroura marginella Woodh. Western Mourning Dove. H.W. Quite abundant, less so than formerly. W.M.P. Pl. III. Fig. 24.

Gymnogyps californianus Shaw. California Condor. One specimen in the department, supposed to have been obtained from hills near Pomona about fifteen years ago. Pl. IV. Fig. 1.

Cathartes aura septentrionalis Wied. Turkey Vulture. L.L.G., H.W. Claremont, Chino, Laguna. Abundant. W.M.P. Pl. IV. Fig. 1.

Circus hudsonius Linn. Marsh Hawk. H.W. Noted from foothills near Etiwanda to Santa Ana river bottoms near Santa Ana. Breeding record near Corona. W.M.P. Pl. IV. Fig. 3.

Accipiter velox Wil. Sharp-shinned Hawk. H.W. Common fall, winter and early spring, mountains to lowlands. W.M.P. Pl. IV. Fig. 4.

Accipiter cooperi Bonap. Cooper Hawk. H.W. Resident in small numbers; most abundant in fall and winter. Breeds in mountain canyons. Recorded from Lytle Creek, San Gabriel, etc. W.M.P. Pl. IV. Fig. 5.

Buteo borealis calurus Cass. Western Red-tailed Hawk. H.W., Illingworth, Metz. Common breeding from coast to mountains. W.M.P. Pl. IV. Fig. 7.

Buteo lineatus elegans Cass. Red-bellied Hawk. H.W. Probably becoming scarcer every year. A few pairs still breed in river bottoms near Corona. W.M.P. Pl. IV. Fig. 6.

Buteo swainsoni Bonap. Swainson Hawk. Found breeding in several instances in river bottom near Corona, also near Chino. Large flocks often seen flying north or south. W.M.P. Pl. IV. Fig. 8.

Archibuteo ferrugineus Licht. Ferruginous Rough-legged Hawk. Rather uncommon. One taken near Corona. Another seen in fall of 1916. W.M.P.

Aquila chrysaetos Linn. Golden Eagle. H.W., Metz. In high mountains. W.M.P. Pl. IV. Fig. 9.

Haliaeetus leucocephalus leucocephalus Linn. Southern Bald Eagle. Near Laguna and San Pedro. W.M.P., L.L.G.

Falco mexicanus Schl. Prairie Falcon. H.W. Not common, fall and winter near Chino. W.M.P. Pl. IV. Fig. 10.

Falco columbarius columbarius Linn. Northern Pigeon Hawk. Rather uncommon. Several taken, all probably this form. Pl. IV. Fig. 11.

Falco sparverius sparverius Linn. American Sparrow Hawk. H.W., L.L.G., Metz, Illingsworth. From the mountains to the sea. W.M.P. Pl. IV. Fig. 12, male. Fig. 13, female.

Pandion haliaetus carolinensis Gmel. American Osprey. Between Laguna and Balboa, summer, 1916. H.H.N. Seen near Newport. W.M.P.

Aluco pratincola Bonap. American Barn Owl. Metz., L.L.G., H.W. Very common, San Dimas Canyon, Claremont, Chino, near Corona, Upland, Laguna. Nests in holes in trees or rocks or in buildings. Eggs from February to May. W.M.P. Pl. IV. Fig. 14.

Asio wilsonianus Less. Long-eared Owl. H.W., Metz. June 7, 1909. One record from Indian Hill, Claremont. Several pairs nesting in willow bottoms near Corona, April, 1915 to 1917. W.M.P. Pl. IV. Fig. 15.

Asio flammeus Pontop. Short-eared Owl. H.W. Hills near Pomona, Nov. 10. Near Corona, Nov. 3. Near Ontario in grain field, Nov. 2. W.M.P. Pl. IV. Fig. 16.

Strix occidentalis occidentalis Xan. Southern Spotted Owl. One record from San Gabriel Canyon, May 1, 1916. W.M.P.

Otus asio quercinus Grin. Southern California Screech Owl. Illingsworth, H.W. Abundant, Claremont, resident breeding. San Dimas and San Antonio Canyons, many records. W.M.P. Pl. IV. Fig. 17.

Bubo virginianus pallescens Stone. Western Horned Owl. One record. Found dead at mouth of San Antonio Canyon, Jan. 10, 1915. W.M.P.

Bubo virginianus pacificus Cass. Pacific Horned Owl. Pair seen at Laguna, 1917; San Antonio Canyon, 1914. Breeding in San Dimas Canyon, Feb. and March, 1917. W.M.P. Pl. IV. Fig. 18.

Speotyto cunicularia hypogæa Bonap. Burrowing Owl. Illingsworth, 1902; Metz, H.W. Near Santa Ana and Irvine. Abundant in fields near Chino and Corona, nesting. Near Claremont, nesting. Nigger Slough, nesting. W.M.P. Pl. IV. Fig. 19.

Glaucidium gnoma californicum Sclat. California Pigmy Owl. One record, San Antonio Canyon. W.M.P. Pl. IV. Fig. 20.

Geococcyx californianus Less. Road Runner. H.W. Claremont. Illingsworth, '96; L.L.G. Laguna, 1914. Formerly much more common. W.M.P. Pl. V. Fig. 1.

Coccyzus americanus occidentalis Ridg. California Cuckoo. Seen H.W. Rather uncommon. Several individuals seen at Corona in willows; one set of three eggs found near Chino. Pl. V. Fig. 2.

Ceryle alcyon caurina Grin. Western Belted Kingfisher. H.W. Noted in migration near Claremont, San Gabriel Canyon, San Antonio Canyon, Glen Ranch, Santa Ana river near Corona. W.M.P. Seen in Pudding Stone Canyon. L.L.G. Pl. V. Fig. 3.

Dryobates villosus hyloscopus Canab. and Hein. Cabinas Woodpecker. H.W. Common in nesting season in higher mountains. Taken in fall in Santa Ana river bottoms and also near El Monte. W.M.P. Pl. V. Fig. 4. Bright red patch on head.

Dryobates pubescens turati Malhe. Willow Woodpecker. H.W. Common in willow bottoms near Corona in spring; also El Monte. One taken in San Antonio and one in San Dimas Canyons in the fall. W.M.P. Pl. V. Fig. 5. Bright red line back of black patch on head.

Dryobates scalaris cactophilus Ober. Cactus Woodpecker. H.W. Several records for Mojave desert. Breeding near Victorville. W.M.P.

Dryobates nuttalli Gamb. Nuttall Woodpecker. Common in canyons up to 5000 feet; also in willow and sycamore groves in lowlands. Nesting, May, 1916, San Gabriel Canyon, Santa Ana river bottoms near Corona, San Antonio Canyon. W.M.P. Pl. V. Fig. 6. Bright red patch back of black patch on head.

Xenopicus albolarvatus gravirostris Grinn. San Bernardino White-headed Woodpecker. Found in the higher mountains of the San Gabriel range, Baldy, Ontario, etc., in summer. W.M.P. Pl. V. Fig. 7. Bright red patch on head.

Sphyrapicus varius daggetti Grinn. Sierra Red-breasted Sapsucker. H.W. Several winter records. W.M.P.. Pl. V. Fig. 8. Head and throat bright red, shaded into yellow on breast.

Melanerpes formicivorus bairdi Ridg. California Woodpecker. H.W., Metz. Nesting and resident. W.M.P. Pl. V. Fig. 9. Bright red patch on back of head, yellow tinge on throat.

Asyndesmus lewisi Riley. Lewis Woodpecker. Common Brown's Flats in spring. H.W. Casual migrant, noted years ago in Blanchard Park, Claremont, in small numbers in spring. W.M.P. Pl. V. Fig. 10. Red spot on front of head, breast streaked with red.

Colaptes cafer collaris Vigors. Red-shafted Flicker. H.W., Metz, H.H.T. Laguna. L.L.G. Abundant, especially fall and winter. Breeds San Antonio Canyon, Santa Ana river bottom. W.M.P. Pl. V. Fig. 11. Red streak on side of throat, under tail and red wing quills.

Phalaenoptilus nuttalli californicus Ridg. Dusky Poor-will. H.W. Fairly common at mouth of San Antonio and San Dimas Canyons in spring. Noted in upper Lytle Creek, Sept., 1915, and Glen Ranch, 1916. W.M.P. Pl. V. Fig. 12.

Chordeiles virginianus hesperis Grinn. Pacific Nighthawk. Found only in Big Bear Valley. Possibly occurs in our mountains. W.M.P. Pl. V. Fig. 13.

Chordeiles acutipennis texensis Law. Texas Nighthawk. H.W. Common about Claremont. W.M.P., Metz. Laguna. H.H.N.

Chaetura vauxi Towns. Vaux Swift. Noted in fall migration, Santa Ana river. W.M.P.

Aeronautes melanoleucus Baird. White-throated Swift. H.W. Capistrano. H.H.N. Noted in migration in fall, Santa Ana river bottoms. Taken along cliffs near Laguna. Spring. W.M.P. Pl. V. Fig. 14.

Archilochus alexandri Bou. and Mul. Black-chinned Hummingbird. H.W. Nestings San Antonio Canyon, near Corona, near Ontario. W.M.P.

Calypte costae Bour. Costa Hummingbird. H.W., Metz. Abundant in mountains and lower. W.M.P. Pl. V. Fig. 15. Throat purple.

Calypte anna Less. Anna Hummingbird. Metz, H.W. Common all year, nests in Claremont. W.M.P. Pl. V. Fig. 16. Red throat.

Selasphorus rufus Gmel. Rufous Hummingbird. H.W., Metz. Common migrant in spring. W.M.P. Pl. V. Fig. 17. Breast brownish, some red spots which are small. Back more brown than others.

Tyrannus verticalis Say. Western Kingbird. H.W. Laguna. L.L.G. Common and nesting, Chino, San Antonio Canyon. W.M.P. Pl. V. Fig. 18. Streak of red on center of head.

Tyrannus vociferans Swains. Cassin Kingbird. H.W. Laguna Gardner. Common migrant near Chino. No nesting records. W.M.P. Pl. V. Fig. 19. Red streak, center of head.

Myiarchus cinerascens cinerascens Law. Ash-throated Flycatcher. H.W. Claremont. Metz. Laguna. L.L.G. Common about Claremont in migrations. Breeding in some of the canyons. W.M.P. Pl. V. Fig. 20.

Sayornis sayus Bonap. Say Phoebe. H.W. Claremont. Metz. Laguna. L.L.G. Common, fall and winter; possibly a few pairs breed. W.M.P. Pl. V. Fig. 25.

Sayornis nigricans Swain. Black Phoebe. H.W. Laguna Gardner. Common from ocean to mountains and into canyons. Many nesting records. W.M.P. Pl. V. Fig. 24.

Nuttallornis borealis Swains. Olive-sided Flycatcher. H.W. Claremont. Metz. Common in higher mountains. Found in valleys during migrations. W.M.P. Pl. V. Fig. 21.

Myiochanes richardsoni richardsoni Swains. Western Wood Pewee. H.W. Abundant and nests in canyons, in valley during migrations. W.M.P. Pl. V. Fig. 26.

Empidonax difficilis difficilis Baird. Western Flycatcher. H.W. Summer resident of canyons; many nesting records for Cucamonga, San Dimas, San Gabriel Canyons. W.M.P.

Empidonax trailli trailli Audub. Traill Flycatcher. H.W. Summer visitant to willow bottoms and in less numbers to canyons. W.M.P. Pl. V. Fig. 22.

Empidonax hammondi Xanthus. Hammond Flycatcher. One record San Dimas Canyon. W.M.P.

Pyrocephalus rubinus mexicanus Sclat. Vermilion Flycatcher. One record Santa Ana river bottom near Corona in winter. W.M.P.

Otocoris alpestris actia Oberh. California Horned Lark. H.W. Claremont. Metz. Laguna. L.L.G. Abundant, resident. W.M.P. Pl. V. Fig. 27.

Cyanocitta stelleri frontalis Ridg. Blue-fronted Jay. H.W. Common resident of mountains from 3,000 to 9,000 feet. One breeding date, May, 1915, San Gabriel Canyon. W.M.P. Pl. V. Fig. 28.

Aphelocoma californica californica Vig. California Jay. H.W. Claremont. Metz. Laguna. L.L.G. Abundant, Claremont and lower canyons. W.M.P. Pl. V. Fig. 29. Bright blue.

Corvus corax sinuatus Wag. Western Raven. Seen. H.W. Laguna. L.L.G., H.H.N. and W.M.P. Pl. V. Fig. 33.

Corvus brachyrhynchos hesperis Ridg. Western Crow. H.W. Very abundant on willow river bottoms, Corona, El Monte. Nest on Santa Ana. W.M.P. Also seen near south hills near Pomona. Pl. V. Fig. 32.

Nucifraga columbiana Wilson. Clarke Nutcracker. H.W. Noted on the high slopes of Mount San Antonio. W.M.P. Pl. V. Fig. 31.

Cyanocephalus cyanocephalus Wied. Pinyon Jay. Seen in flocks in spring of 1917 near Box S Ranch on Mojave Desert. Records for San Bernardino Range, not for San Gabriel. W.M.P. Pl. V. Fig. 30. Bluish grey.

Molothrus ater obscurus Gmel. Dwarf Cowbird. Eggs probably of this species found in Santa Ana river flats near Corona on several occasions. W.M.P.

Xanthocephalus xanthocephalus Bonap. Yellow-headed Blackbird. H. W. Collected during migration in spring near Chino, and nesting near Nigger slough. W.M.P. Pl. V. Fig. 34.

Agelaius phoeniceus neutralis Ridg. San Diego Red-winged Blackbird. H.W. Very abundant in lowlands about Chino. W.M.P. Pl. V. Fig. 35.

Agelaius tricolor Audub. Tri-colored Red-winged Blackbird. H.W. Several specimens taken near Corona, Chino, etc. W.M.P.

Sturnella neglecta Audub. Western Meadowlark. H.W., Metz. Abundant in lowlands common about Claremont. W.M.P. Pl. V. Fig. 36. Canary yellow on throat, side and breast.

Icterus parisorum Bonap. Scott Oriole. H.W. Quite common on Mojave Desert. W.M.P. Pl. V. Fig. 38. Black and very deep yellow.

Icterus cucullatus nelsoni Ridg. Arizona Hooded Oriole. H.W. Claremont. Metz. Laguna. L.L.G. Locally common at Ontario, Claremont, Pomona, etc. Many nesting dates, usually nesting in palms. W.M.P. Pl. V. Fig. 37. Black and very deep yellow.

Icterus bullocki Swains. Bullock Oriole. H.W. Claremont. Metz. Abundant from ocean to 5,000 feet. Breeding at Hesperia. W.M.P. Pl. V. Fig. 39. Black and orange.

Euphagus cyanocephalus Wag. Brewer Blackbird. H.W., Metz. Especially abundant in Claremont. Many records. W.M.P.

Carpodacus purpureus californicus Baird. California Purple Finch. H.W. Winter visitant to Claremont, San Antonio Canyon. W.M.P. Pl. VI. Fig. 1. Head and throat a rich red.

Carpodacus cassinii Baird. Cassin Purple Finch. H.W. Claremont. Metz. Winter migration record for Claremont, Pomona,

San Antonio Canyon. W.M.P. Pl. VI. Fig. 2. Top of head rich red, thorax and sides tinged with red.

Capodacus mexicanus frontalis Say. California Linnet. H.W. Claremont. Metz. Laguna. L.L.G. Abundant from ocean to mountains. Less common above 3,000 feet. Nests about buildings and in cactus. W.M.P. Pl. VI. Fig. 3. Head and throat rich red.

Astragalinus tristis salicamans Grinn. Willow Goldfinch. H.W. Claremont. Metz. Redlands, San Antonio Station; very abundant El Monte, Corona. Many nesting records in bottoms. W.M.P. Pl. VI. Fig. 4. Breast and neck canary yellow.

Astragalinus psaltria hesperophilus Ober. Green-backed Goldfinch. H.W. Claremont. Metz. Claremont, San Antonio Canyon, Corona, Laguna. Common. Breeding San Antonio Canyon. Claremont, near Covina. W.M.P. Pl. VI. Fig. 5. Breast canary yellow, back yellowish-green.

Astragalinus lawrencei Cass. Lawrence Goldfinch. H.W. Breeding in Claremont, San Antonio Canyon, near Corona. Found also in upper San Gabriel. W.M.P. Pl. VI. Fig. 6. Canary yellow breast, streaks on wings.

Spinus pinus pinus Wilson. Pine Siskin. Common winter visitant to San Antonio and other parts of mountains. W.M.P. Pl. VI. Fig. 7.

Passer domesticus Linn. English Sparrow. H.W. Noted at Claremont, Pomona, Ontario, San Bernardino, Victorville, Hesperia, El Monte, Box S. Ranch. W.M.P. Pl. VI. Fig. 8.

Pooecetes gramineus confinis Miller. Western Vesper Sparrow. H.W. Several records, fall and winter, Corona, Chino, near Etiwanda. W.M.P. Pl. VI. Fig. 9.

Pooecetes gramineus affinis Miller. Oregon Vesper Sparrow. Probably occurs. H.W.

Passerculus sandwichensis alaudinus Bonap. Western Savanna Sparrow. H.W. Abundant in lowlands, winter and fall. W.M.P. Pl. VI. Fig. 11.

Passerculus rostratus rostratus Cass. Found quite commonly near Oceanside. October 19, 1916. W.M.P.

Passerculus beldingi Ridg. Belding Marsh Sparrow. Common at Newport. One breeding record. W.M.P. Pl. VI. Fig. 12.

Ammodramus savannarum bimaculatus Swain. Western Grasshopper Sparrow. H.W. Records as follows: One male, near Corona, Calif.; one female, mouth of Lytle Creek Canyon, September 11, 1915; May 22, 1915, several Nigger Slough, near San Pedro. W.M.P. Pl. VI. Fig. 13.

Chondestes grammacus strigatus Swain. Western Lark Sparrow. H.W. Claremont. Metz. Laguna. L.L.G. Abundant near Corona, Chino, mouth of Lytle Creek Canyon; fairly common Mojave Desert. Claremont. W.M.P. Pl. VI. Fig. 17.

Zonotrichia leucophrys leucophrys Forst. White-crowned Sparrow. North of Claremont. In college collection. H.W. Two records, near Claremont. Specimen from desert in spring. W.M.P. Pl. VI. Fig. 18.

Zonotrichia leucophrys gambeli Nutt. Intermediate Sparrow. H.W. Very abundant ocean to foothills, fall and winter. Recorded late in April from Claremont. W.M.P. Pl. VI. Fig. 19.

Zonotrichia coronata Pall. Golden-crowned Sparrow. H.W. Winter, San Dimas, upper San Antonio, along foothills. W.M.P. Pl. VI. Fig. 15.

Spizella passerina arizonae Coues. Western Chipping Sparrow. H.W. Claremont. Metz. Breeding records, Claremont. W.M.P.

Spizella breweri Cass.. Brewer Sparrow. Migration records in spring, Claremont. W.M.P. Pl. VI. Fig. 16.

Spizella atrogularis Caban. Black-chinned Sparrow. Seen. H.W. Migration records in spring. W.M.P. Pl. VI. Fig. 10.

Junco oreganus thurberi Anthony. Sierra Junco. H.W., Metz. Common; breeds in mountains, in valleys in spring. W.M.P. Pl. VI. Fig. 14.

Amphispiza bilineata deserticola Ridg. Desert Black-throated Sparrow. H.W. One record for Claremont. Specimen in Pomona College collection. Abundant, breeding in desert near Victorville, spring 1917. W.M.P. Pl. VI. Fig. 20.

Amphispiza belli Cass. Bell Sparrow. H.W. Claremont. Metz. Common, breeding near Claremont. Found up to San Antonio Canyon. W.M.P. Pl. VI. Fig. 21.

Amphispiza nevadensis canescens Grinn. California Sage Sparrow. H.W. Fall; common at Glenn Ranch. W.M.P. Pl. VI. Fig. 22.

Aimophila ruficeps ruficeps Cass. Rufous-crowned Sparrow. H.W. Laguna. L.L.G. Resident foothills near Claremont, mouth of San Antonio Canyon. W.M.P. Pl. VI. Fig. 23.

Melospiza melodia cooperi Ridg. San Diego Song Sparrow. H. W. Claremont. Metz. Laguna. L.L.G. Very abundant in river bottoms; many breeding records; Claremont to coast. W.M.P. Pl. VI. Fig. 27.

Melospiza lincolni lincolni Aud. Lincoln Sparrow. H.W. Winter resident to our valleys. W.M.P. Pl. VI. Fig. 24.

Certain of the fox sparrows are very hard to place. The notes that I give are only provisional and further study of this group may place these under different sub-species. Then there are many intergrades that are difficult to correctly place. The sub-species that are hard to differentiate are as follows:

Passerella iliaca unalascheensis Gmel. Shumagin Fox Sparrow. Taken in winter, San Antonio Canyon.

P. i insularis Rid. Kadiak Fox Sparrow. Winter, San Antonio Canyon.

P. i sinuosa Grinn. Valdez Fox Sparrow. San Dimas Canyon in winter.

P. i meruloides Vig. Yakutat Fox Sparrow. Several San Antonio Canyon in winter.

P. i altivagans Rid. Alberta Fox Sparrow. Several in winter, San Dimas Canyon. W. M. P.

Passerella iliaca schistacea Baird. Slate-colored Fox Sparrow. Taken in winter, San Dimas Canyon; Lytle Creek in fall. W.M.P.

Passerella iliaca megarhyncha Baird. Thick-billed Fox Sparrow. Recorded in winter, San Antonio Canyon, San Dimas Canyon. W. M. P.

Passerella iliaca stephensi Anth. Stephens Fox Sparrow. H.W. No valley records. W.M.P. Pl. VI. Fig. 26.

Pipilo maculatus megalonyx Baird. Spurred Towhee. H.W. Claremont. Metz. Abundant, breeding in Claremont, Corona, San Antonio Canyon, Laguna. W.M.P. Pl. VI. Fig. 28.

Pipilo crissalis senicula Anth. Anthony Brown Towhee. H.W. Claremont. Metz. Abundant, breeding Claremont to Laguna. W.M.P. Pl. VI. Fig. 30.

Oreospiza chlorura Audub. Green-tailed Towhee. H.W. Breeds on high mountains (about 8,000 feet), Lytle Creek, near Corona in winter. W.M.P. Pl. VI. Fig. 29.

Zamelodia melanocephala capitalis Baird. Pacific Black-headed Grosbeak. Metz. Claremont. H.W. Breeding at Claremont, near Corona. W.M.P. Pl. VI. Fig. 31. Female.

Guiraca caerulea salicarius Grinn. California Blue Grosbeak. H. W. Laguna. H.H.N. Santa Ana river bottom in spring; Brea Canyon. W.M.P. Pl. VI. Fig. 32. Dark blue, rufous on wings.

Passerina amoena Say. Lazuli Bunting. H.W. Claremont. Metz. Fairly common in Claremont, seen in Brea Canyon and near Chino, San Antonio Canyon, San Dimas Canyon. W.M.P. Pl. VI. Fig. 33. Bright blue touched with rufous.

Calamospiza melanocorys Stejn. Lark Bunting. One record near Corona, May 11, 1915. W. M. P.

Piranga ludoviciana Wilson. Western Tanager. H.W. Common in canyons in summer, upper San Antonio, Cucamonga; breeding records; spring migration records for Claremont. W.M.P. Pl. VI. Fig. 34. Head brilliant red shaded over yellow.

Progne subis hesperia Brew. Western Martin. Two specimens in college collection, taken 1896. Pl. VI. Fig. 35. Female.

Petrochelidon lunifrons lunifrons Say. Cliff Swallow. H.W. Long Beach. Metz. Laguna Beach Gardner. Breeding. Very abundant from mouth of San Antonio to ocean; nests on barns, houses, etc.; cliffs near Laguna. W.M.P. Pl. VI. Fig. 36.

Hirundo erythrogaster Bodd. Barn Swallow. Seen. H.W. Migration records for Chino, Corona, Laguna. W.M.P. Pl. VI. Fig. 38.

Iridoprocne bicolor Vieil. Tree Swallow. H.W. Breeds near Corona; seen in winter in same locality less commonly. W.M.P. Pl. VI. Fig. 39.

Tachycineta thalassina lepida Mearns. Northern Violet-green Swallow. H.W. Claremont. Metz. Breeds in San Antonio Canyon.

Riparia riparia Linn. Bank Swallow. Nesting record for Newport, June, 1916. Migration record near Corona in spring. W.M.P. Pl. VI. Fig. 37.

Stelgidopteryx serripennis. Audub. Rough-winged Swallow. Pl. VI. Fig. 40.

Bombycilla cedrorum Vieill. Cedar Waxwing. H.W. Claremont. L.L.G. Very abundant in fall, winter and spring, Claremont, Ontario, Pomona, San Antonio, San Dimas. W.M.P. Pl. VII. Fig. 1.

Phainopepla nitens Swain. Phainopepla. H.W. Claremont. Metz. Breeding records Claremont; winters regularly near Corona in river bottoms. Some winters seen in Claremont. W.M.P. Pl. VII. Fig. 2.

Lanius ludovicianus gambeli Ridg. California Shrike. H.W. Laguna. L.L.G. Resident. Breeds Corona, Chino, Ontario; common at Claremont. W.M.P. Pl. VII. Fig. 3.

Vireosylva gilva swainsoni Baird. Western Warbling Vireo. H.W. Abundant in summer in canyons. Breeds. W.M.P. Pl. VII. Fig. 4.

Lanivireo solitarius cassinii Xant. Cassin Vireo. H.W. San Antonio, Glenn Ranch. W.M.P. Pl. VII. Fig. 6.

Vireo huttoni huttoni Cass. Hutton Vireo. H.W. Claremont, San Antonio Canyon. Nests. Resident. W.M.P. Pl. VII. Fig. 5.

Vireo belli pusillus Coues. California Least Vireo. H.W. Laguna. L.L.G. Fairly common Glenn Ranch and near Corona. Breeding notes. W.M.P.

Vireo vicinior Coues. Gray Vireo. Capistrano. H.H.N. Several seen in Cajon Pass, elevation 3,700 feet. W.M.P.

Vermivora ruficapilla gutturalis Ridg. Calaveras Warbler. H.W. Migrates. Glenn Ranch, San Gabriel Canyon. W.M.P.

Vermivora celata lutescens Ridg. Lutescent Warbler. H.W. Glenn Ranch, San Gabriel Canyon, San Antonio and San Dimas Canyons. W.M.P. Pl. VII. Fig. 7. Canary yellow.

Vermivora celata sordida Towns. Dusky Warbler. San Dimas Canyon. Winter. W. M. P.

Dendroica aestiva brewsteri Grinn. California Yellow Warbler. H.W., Metz. Claremont. Breeding near Corona river bottoms. Pl. VII. Fig. 8. Canary-yellow.

Dendroica auduboni auduboni Towns. Audubon Warbler. H.W. Claremont. Metz. Abundant in winter in San Antonio Canyon, Claremont, Pomona, Corona. Breeds in higher mountains. W.M.P.

Pl. VII. Fig. 10. Five yellow spots, top of head, throat, under wings, on rump.

Dendroica nigrescens Towns. Black-throated Gray Warbler. Seen. H.W. Breeds near Camp Baldy and Cold Brook, San Gabriel Canyon. W.M.P. Claremont during migration. Pl. VII. Fig. 9. Small yellow spot in front of eye.

Dendroica occidentalis Towns. Hermit Warbler. H. W. Seen. Migration near Corona, Santa Ana river bottom, upper Lytle Creek. W.M.P. Pl. VII. Fig. 11. Bright yellow on side and top of head.

Oporornis tolmiei Towns. Tolmie Warbler. Migration notes from Cold Brook, Glenn Ranch, Claremont, upper Lytle Creek. W.M.P.

Geothlypis trichas occidentalis Brew. Western Yellowthroat. H.W. Taken in migration at Claremont. Breeds on river bottoms near Corona, Chino and El Monte. W.M.P. Pl. VII. Fig. 12. Bright yellow throat, back greenish grey.

Icteria virens longicauda Lawr. Long-tailed Chat. H.W. Breeds near Corona. W.M.P. Pl. VII. Fig. 13. Bright yellow throat.

Wilsonia pusilla chryseola Ridg. Golden Pileolated Warbler. H.W. Migration near Claremont. One breeding record. Santa Ana river bottoms. W.M.P. Pl. VII. Fig. 14. Canary-yellow throat. Back greenish-grey.

Wilsonia pusilla pileolata Pall. Alaska Pileolated Warbler. Capistrano. H.H.N.

Anthus rubescens Tunst. American Pipit. H.W. Long Beach. Metz. Abundant fall and winter, Corona, Chino, Ontario. W.M.P. Pl. VII. Fig. 15.

Cinclus mexicanus unicolor Bonap. American Dipper. H. W. Resident San Antonio, San Dimas, Cucamonga, Lytle Creek. W.M.P. Pl. VII. Fig. 16. Female.

Oreoscoptes montanus Towns. Sage Thrasher. Taken fall and winter in Corona, near Etiwanda. Seen in early May, upper Cajon Pass. W.M.P. Pl. VII. Fig. 17.

Mimus Polyglottos leucopterus Vigors. Western Mockingbird. H.W. Claremont. Metz. Laguna. L.L.G.' Breeds in Claremont. W.M.P. Pl. VII. Fig. 18.

Toxostoma redivivum pasadenense Grinn. Pasadena Thresher. H.W. Claremont. Metz. Laguna. L.L.G. Breeds at Claremont. W.M.P. Pl. VII. Fig. 19.

Toxostoma lecontei lecontei Law. Leconte Thrasher. Seen on Mojave Desert. H.W. Resident, breeding, limited numbers, Mojave Desert. W.M.P.

Heleodytes brunneicapillus couesi Sharpe. Northern Cactus Wren. H.W. Claremont. Metz. Common resident, breeding. W.M.P. Pl. VII. Fig. 21.

Salpinctes obsoletus obsoletus Say. Rock Wren. H.W. Many records, Claremont, San Antonio Canyon; higher mountains in summer. W.M.P. Pl. VII. Fig. 23.

Catherpes mexicanus punctulatus Ridg. Dotted Canyon Wren. H. W. Laguna. L.L.G. Nesting at San Gabriel, Cucamonga. Fairly common. W.M.P. Pl. VII. Fig. 22.

Thryomanes bewicki charienturus Oberh. San Diego Wren. H. W. Claremont. Metz. Breeding at Claremont, San Antonio, San Dimas Canyons. W.M. P. Pl. VII. Fig. 20.

Troglodytes aedon parkmani Audub. Western House Wren. H.W. Breeding up as far as Camp Baldy. W.M.P. Pl. VII. Fig. 25.

Telmatodytes palustris paludicola Baird. Tule Wren. H. W. Abundant and breeding in Santa Ana river bottom. W.M.P. Pl. VII. Fig. 24.

Nannus hiemalis pacificus Baird. Western Winter Wren. One record, San Dimas Canyon, Jan. 21, 1915. W.M.P.

Certhia familiaris zelotes Osg. Sierra Creeper. Lytle Creek. Glenn Ranch. W.M.P. Pl. VII. Fig. 26.

Sitta carolinensis aculeata Cass. Slender-billed Nuthatch. Seen. H.W. Recorded upper Lytle Creek, Glenn Ranch. W.M.P. Pl. VII. Fig. 27.

Sitta pygmaea pygmaea Vigors. Pigmy Nuthatch. Upper Lytle Creek. W.M.P. Pl. VII. Fig. 28.

Baeolophus inornatus inornatus Gamb. Plain Titmouse. H.W. Oaks near Claremont. W.M.P. Pl. VII. Fig. 29.

Penthestes gambeli baileyae Grinn. Baily Chickadee. H.W. Common higher mountains. Sometimes occurs in winter in valleys. Recorded several times from foothills near San Antonio and San Dimas Canyons. Pl. VII. Fig. 34.

Psaltirparus minimus minimus Ridg. Coast Bush-tit. H.W. Claremont. Metz. Common, breeding at San Dimas, San Antonio, Claremont. Pl. VII. Fig. 30. May be A.O.U. 743A. W.M.P.

Chamaea fasciata henshawi Ridg. Pallid Wren-tit. H.W. Laguna L.L.G. Abundant and breeding Claremont to Laguna, also up in mountains some distance. W.M.P. Pl. VII. Fig. 35.

Regulus satrapa olivaceus Baird. Western Golden-crowned Kinglet. Recorded in winter, San Antonio Canyon. W.M.P.

Regulus calendula cineraceus Grinn. Western Ruby-crowned Kinglet. H.W. Claremont. Metz. Recorded in winter, San Antonio, San Dimas Canyon, Corona. W.M.P. Pl. VII. Fig. 33. Bright red line on top of head.

Polioptila caerulea obscura Ridg. Western Gnatcatcher. H.W. Claremont. Metz. Common and breeding San Antonio Canyon, San Dimas, San Gabriel Canyon, Claremont. W.M.P. Pl. VII. Fig. 32.

Polioptila californica Brew. Black-tailed Gnatcatcher. H.W. Claremont. Metz. Many breeding records. Claremont. W.M.P. Pl. VII. Fig. 31.

Myadestes townsendi Audub. Townsend Solitaire. H.W. Taken in winter. Fairly common in San Antonio Canyon and San Dimas Canyon. Seen in Claremont in winter. W.M.P. Pl. VII. Fig. 36.

Hylocichla guttata nanus Audub. Dwarf Hermit Thrush. H.W. Breeds near Corona, Glenn Ranch. W.M.P. Pl. VII. Fig. 37.

Hylocichla guttata nanus Audub. Dwarf Hermit Thrush. H.W. One bird taken in winter near Claremont which Grinnell thinks is this. W.M.P.

Hylocichla guttata guttata Pall. Alaska Hermit Thrush. H.W. San Dimas Canyon, Claremont. W.M.P.

Hylocichla guttata sequoiensis Baldy. H.W. Sierra Hermit
Thursh. Lytle Creek. W.M.P

Planesticus migratorius propinquus Ridg. Western Robin.
H.W. Common in winter, Claremont. W.M.P. Pl. VII. Fig. 38.

Ixoreus naevius meruloides Gmel. Varied Thrush. H.W.
Winter records, San Dimas Canyon and Claremont. W.M.P. Pl.
VII. Fig. 39.

Sialia mexicana occidentalis Towns. Western Bluebird. H. W.
Claremont. Metz. Breeding record, San Dimas Canyon. Com-
mon in winter in valley. Breeds in higher mountains. W.M.P.
Pl. VII. Fig. 40. Purple-blue, rufus on wings.

Sialia currucoides Bechst. Mountain Bluebird. H.W. Many
records for winter, Etiwanda, Corona, Chino, Pomona. W.M.P.
Pl. VII. Fig. 41. Light blue, greenish blue on throat.

(Contribution from the Zoological Laboratory of Pomona College)

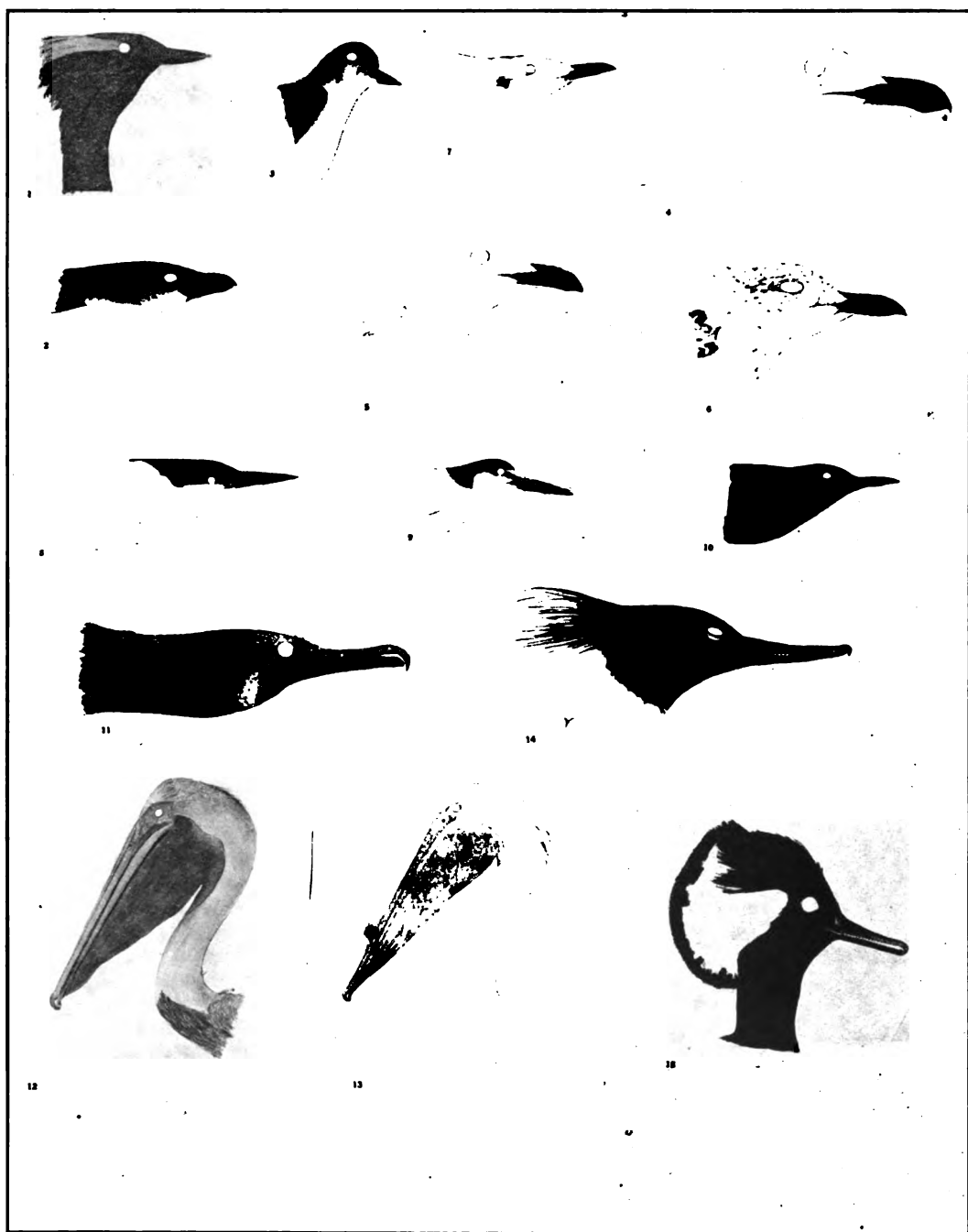


Plate I

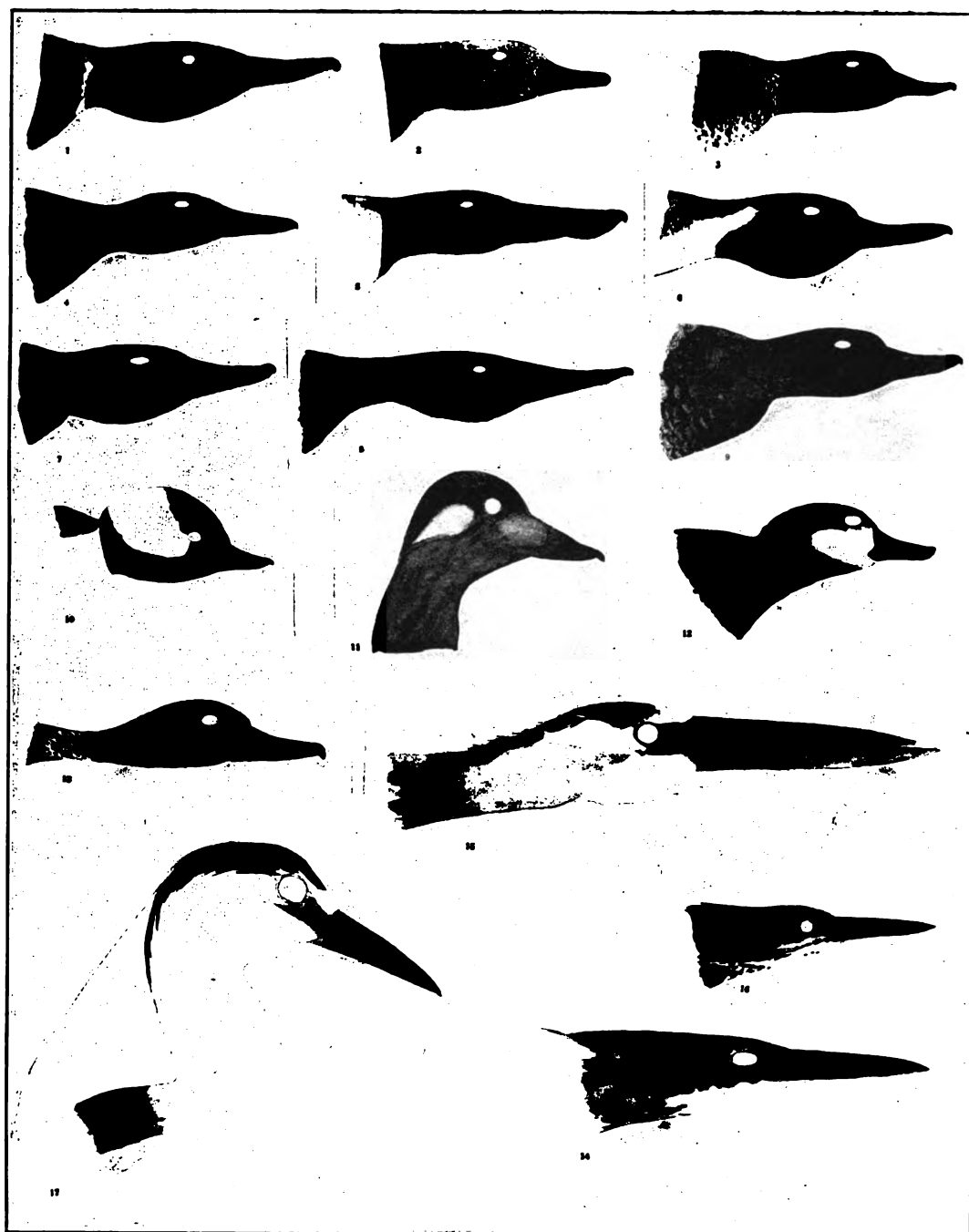


Plate II



Plate III

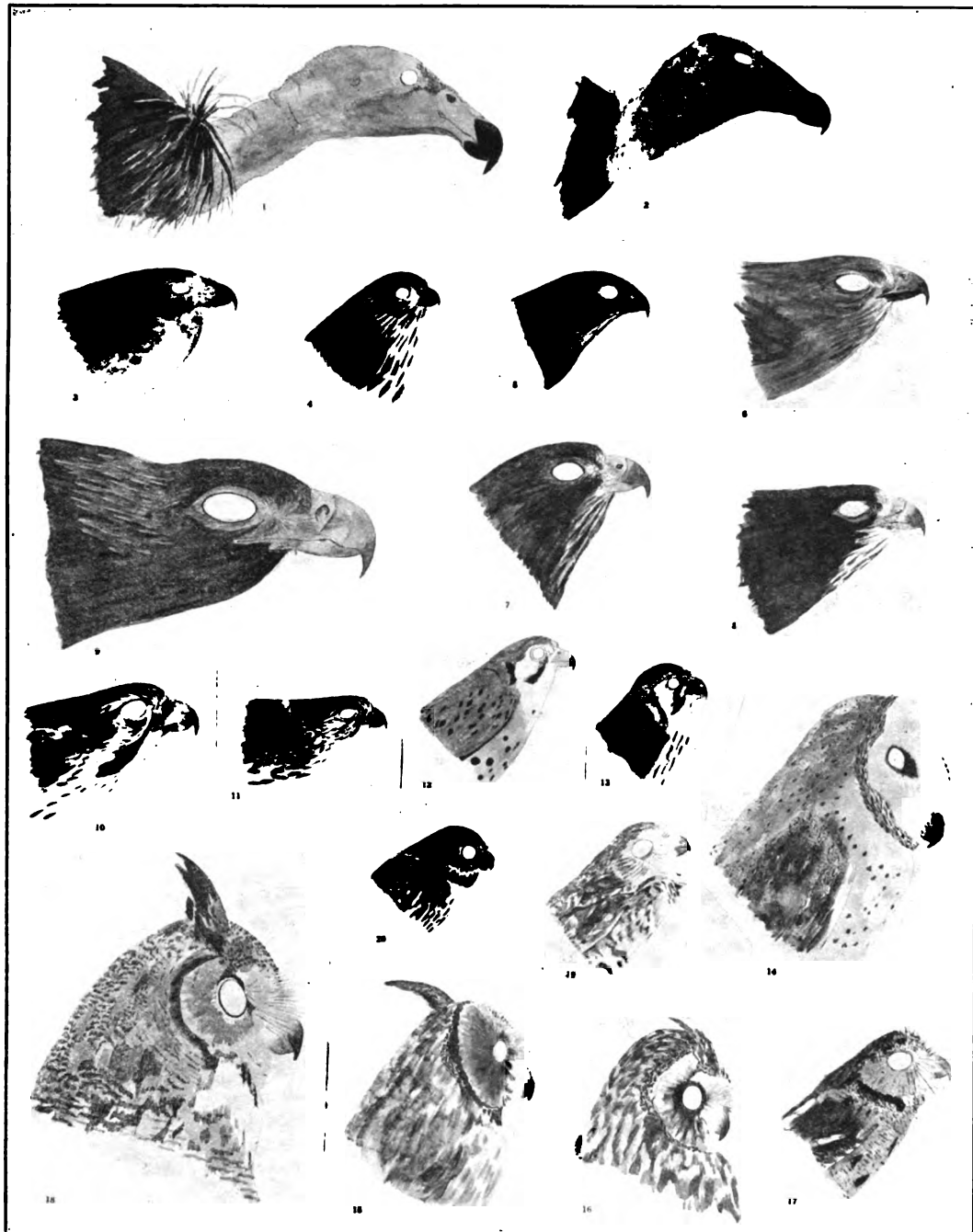


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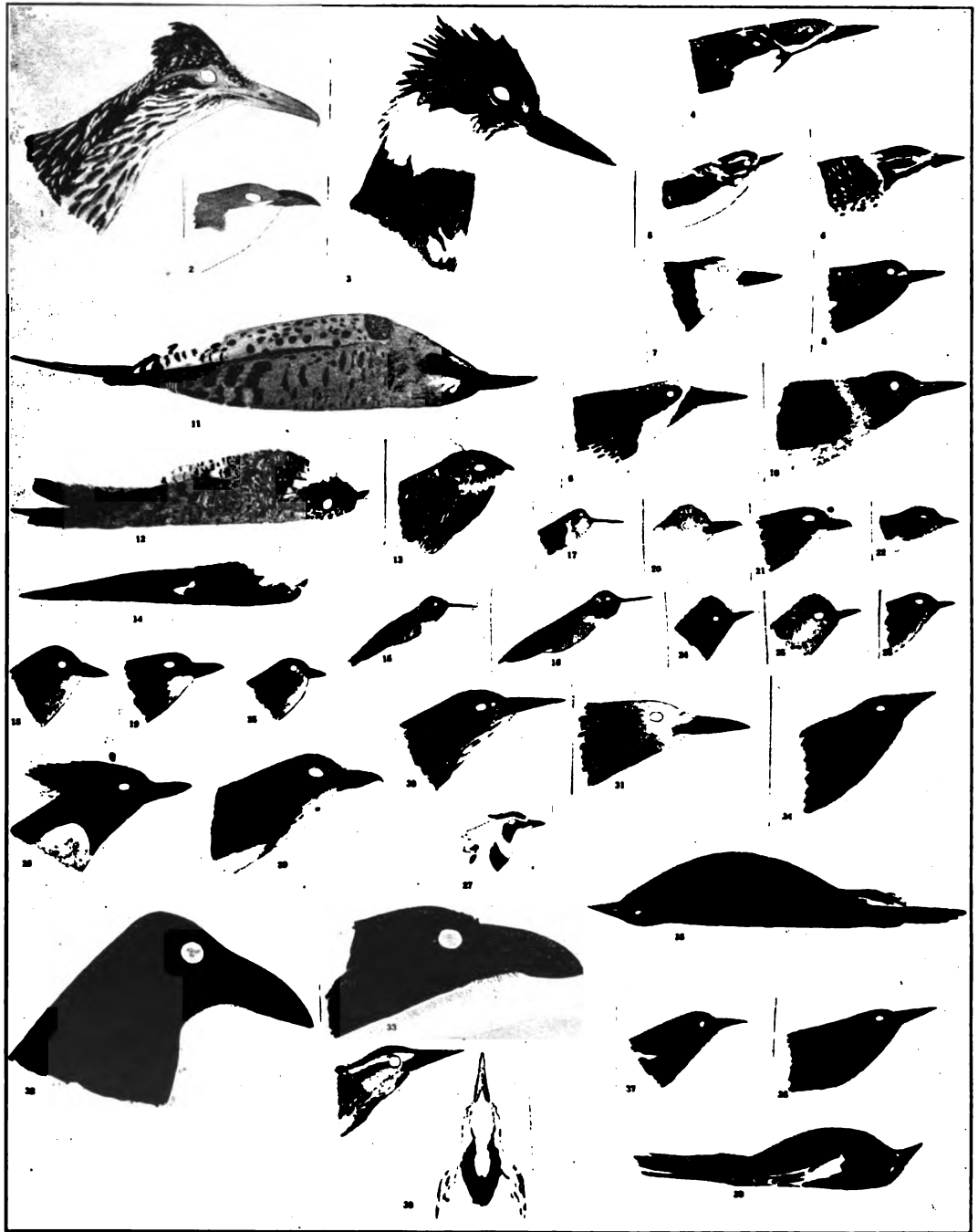


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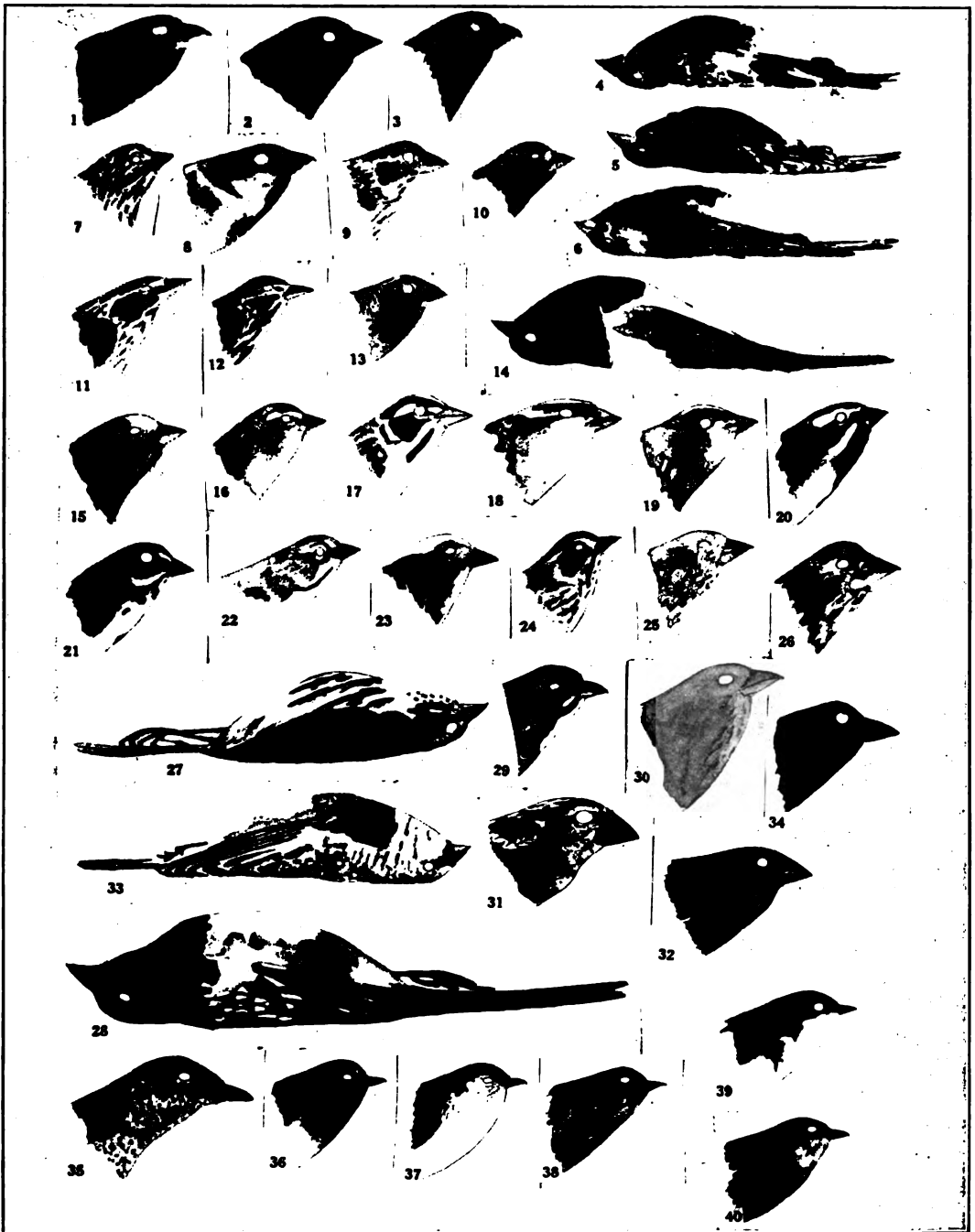


Plate VI

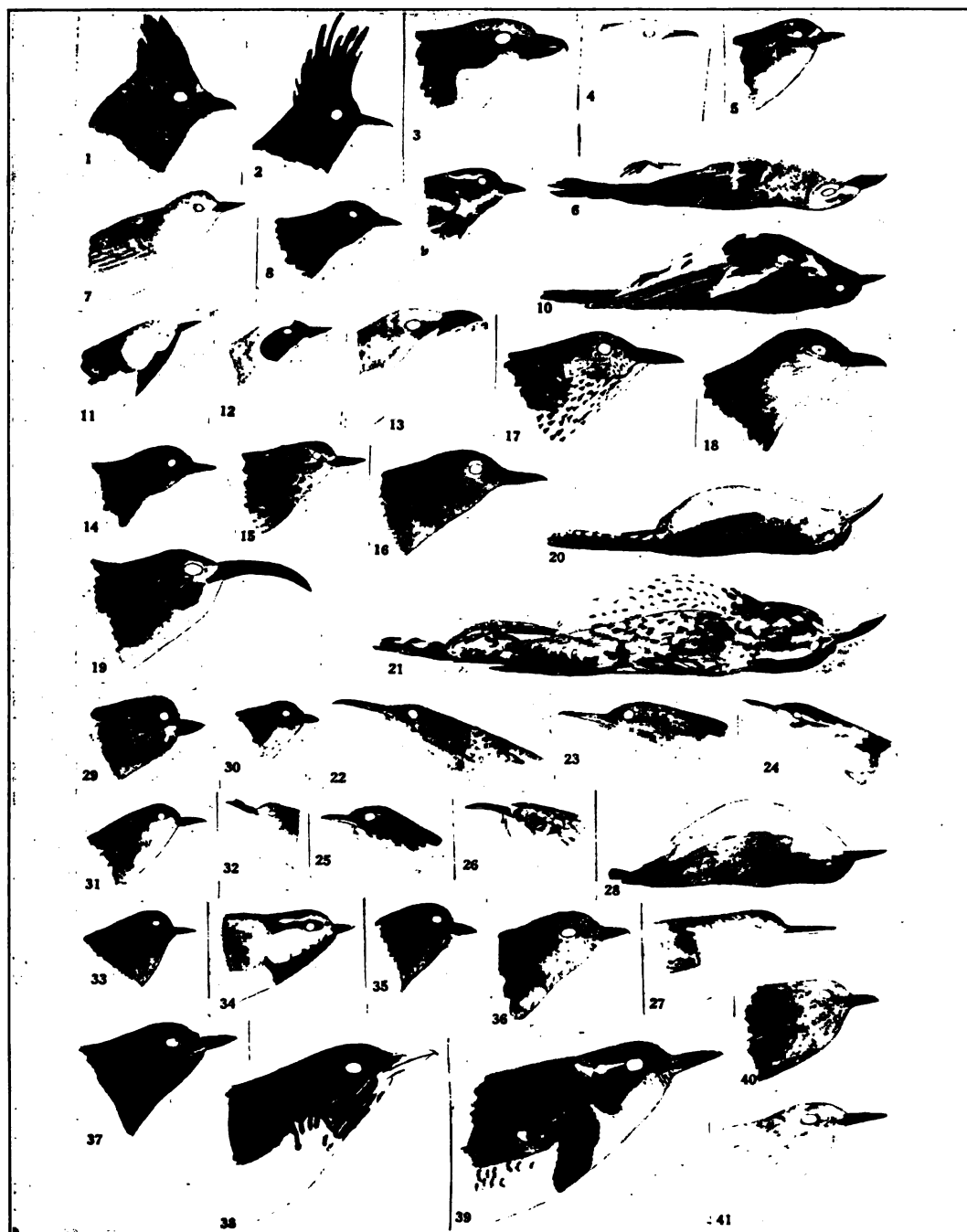


Plate VII

The Nervous System of *Aracoda Semimaculata* and the Description of a Method of Stereographic Reconstruction

WILLIAM F. HAMILTON

Aracoda semimaculata, of the family Lumbriconereidæ (polychætous annelids) is found in great abundance in the mussel beds near Laguna Marine Laboratory. In length the worm may be from five to fifty cm. and in diameter, from two to six mm. In general appearance these worms resemble the earth worm, being without palpi, or tentacles and usually of a reddish brown color. Pigmentation, however, varies from a deep reddish brown to a pale yellow. The cuticle is a tough chitinous membrane clear yellow in cross section, but due to the fact that it is laid on in exceedingly thin laminæ it presents a beautifully iridescent surface.

The prostomium (Fig. 1), is a blunt, ovoid and slightly depressed organ which is practically made up of nervous and sensory tissue, constructed and inter-related in a very complex manner. The peristomium is about as long as the prostomium and twice as long as the body segments (Fig. 3). The body segments are unianulate and very distinct. The parapodia (Fig. 3; a), are biramous, the neuropodium, typically—in the middle segments of the worm—being distinctly longer than the notopodium and bent up finger-like at the tip. The notopodium appears as a broadly rounded discontinuation of the upper half of the body of the parapodium. It is equipped with a varying number of winged pointed setæ and blunt uncinat setæ. The front and hind parapodia become less and less typical as the ends of the worm are approached.

METHODS

Fixation. A large number of the worms, fixed in acetic sublimate and in hot mercuric chlorid were prepared during the summer at the Laguna Marine Laboratory, transferred to 80 per cent alcohol and saved for study the following winter in Claremont. Those fixed in the acetic mixture could easily be sectioned whole in

paraffin of a melting point of 60-62 degrees, but it was necessary to peel off the cuticle and withdraw the setæ of those fixed in hot mercuric chlorid. The internal connective tissues, however, were better preserved in this fluid. There seemed to be no marked difference in fixation of the other tissues.

Staining. The most effective stain for tracing out gross anatomy and nerve distribution proved to be a faintly acidified borax carmine used after a fixation of hot mercuric chlorid. The muscular and epithelial tissues were stained a uniform light pink, the nervous tissues a darker pink and the connective tissues, especially the perineurium a bright red. Villain's copper hematoxylin, iron hematoxylin, and double stains of these and methylin blue with eosin, "licht grün" and neutral red were of value for cellular detail.

Reconstruction Method. A wax and blotting paper model of the brain (Fig. 2), was made in the usual way. To supplement this two stereographic reconstructions (Figs. 1, 4) were made which were of advantage over the wax model in the following ways. They are easier to make, eliminating the steps that involve cutting out, impregnating and reassembling the parts of the wax reconstruction. It is possible as was done in Fig. 1 to make a "sciagraphic reconstruction" that will show the internal parts in their normal relation to the other organs. If necessary, colors could be used to make the morphological differentiation clearer. When the reconstruction is finished it is the reproduction at a certain magnification of any desired aspect of the object and is equal in all important respects and superior in many respects to a photograph or drawing of a wax reconstruction. What little distortion there is may be calculated as a function of the displacement angle and easily taken into account.

The method pursued may be described as follows: The object should be embedded with a piece of liver or similar tissue having a smooth and quite rectangular face parallel to the axis of the specimen. The pieces may be arranged on a watch crystal after infiltration and the embedding paraffin poured on hot enough not to form a crystallization capsule around them. This gives an orientation guide whose projection is represented in b (Fig. 14). Fig. 14 is a

diagrammatic illustration of the reconstruction of one cylinder inside another by means of this method.

The sections are cut at right angles to the orientation plane and hence transversely to the axis of the object. The knife must be sharp and care must be taken in the mounting to prevent any warping or wrinkling of the sections. An outline of the first section is drawn by means of a projection lantern—represented by the shaded circles (Fig. 14; a)—and a line drawn on the projection of the edge of the section of the liver-piece, represented by the first cross line on b (Fig. 14). From the ends of this cross line are drawn lines in that direction from the cross line that is related to the cross line in the same way as the side of the drawing, which is a projection of part of the aspect to be reconstructed, is related to the center of the drawing. These two lines (the long parallel lines, Fig. 14; b), determine the projection of the orientation plane, and on them are measured off segments about equal to half of the product of the thickness of the sections times the magnification in diameters. The projection of the second section of the series is so placed that the projection of the edge of the liver section coincides with a line drawn between the dots marking off the first segment on the lines determining the orientation plane. The section itself is outlined in the same way except that those parts of the second outline which are “covered up” or are within the area bounded by the first outline are left blank, since they represent the parts of the surface which are hidden from view by the outcurving nearer surfaces. The process is repeated progressively along the segments of the displacement lines with all of the rest of the sections. Those lines which form the edges of the completed figure are re-enforced and then transferred to a separate sheet of paper. This bare outline is shaded to fill out the contour of which the lines on the other sheet are a topographic diagram as shown (Fig. 14c).

It is obvious that the cylinder is somewhat distorted since the face of the figure seen from this point of view should be an ellipse. The distortion is known as a sheering distortion, but as it is constant and does not appreciably alter the relations of the parts the distorted reconstruction is quite as useful as the normal one.

The distortion may be eliminated in either of two ways. The first and best is to set the orientation guide at an angle of about 45 degrees from the axis of the object and cut the sections at right angles to the orientation guide and hence obliquely to the specimen. The reconstruction lines are drawn in the same way except that the projection of the orientation line is allowed to fall in the same place each time, thus eliminating the displacement and consequent distortion. It is hard, however, to get a clear idea of the relations of parts from oblique sections. The reconstruction does not show any more than one that follows the first method, and each series is good for reconstructing only one aspect.

The other way of getting rid of the distortion is to insert at the place of proper magnification in the cone of light rays from the projector a lense of sufficient curvature to refract the rays into a parallel bundle. By tilting the drawing board at a proper angle to this bundle the field will be caused to fall in such an ellipse as to eliminate any distortion. This angle is one whose tangent equals the displacement divided by the product of the thickness of the section times the magnification in diameters.

Occasionally wrinkling of the section in cutting or in mounting occurs and renders it necessary to disregard the orientation guide. It is easy, however to put the section in approximately its right place and to check it up by the next section. In reconstructing symmetrical specimens where there is a clearly marked axial line it is often possible to dispense with the orientation guide and to place the successive sections from landmarks which they themselves bear.

ANATOMY

The brain (Fig. 1, 2, 4) is a very complex structure. Topographically it is divided into two parts, the dorsal and ventral by the central mass of muscle and blood vessels (Figs. 5, 6, 7; q), which tissue, going forward from between the central part of the brain and the visceral ganglion, pinches out into a muscular sheet at either side and separates the six dorsal lobes from the eight to ten ventral lobes or branches of the fore part of the brain. The brain is symmetrical and is divided into lateral halves by a septum which continues as a canal through the main brain (Fig. 6; w).

Along slightly different lines the brain may be divided into sensory, cross-connective visceral and nuchal parts.

Sensory System. The prostomial system of sense organs in this form is one of the most complex and highly specialized among annelids. Just forward of the central cross-connective part (Fig. 6) the brain divides into two lateral halves, which extend down and connect with the two front branches of the visceral ganglion. These halves (Fig. 7), give off two rounded lateral sensory lobes (Figs. 1, 4, 6; b) and then divide into quadrants, the larger of which compose the lower pair. Each of these lower quadrants subdivides into four and sometimes five lobes (Figs. 1, 4, 5; c). The inner three are long and slender, while the outer one, which shows a tendency in large specimens to subdivide at the tip is much shorter and broader. The dorsal pair of quadrants each divide into three distinctly longer and more slender lobes, giving in all from fourteen to sixteen lobes. The lobes are each composed of a cellular and a fibrilar tract. The fiber bundle is on the inside and runs directly back to the main brain, while the cellular area is on the surface side of each lobe and is directly connected with the subcuticular sense organs. These cells (Fig. 12; u), underlie the whole of the prostomial cuticle and are connected with the brain by means of fibers which run into the brain in larger or smaller irregularly placed bundles or even as individual fibers, threaded between the epithelial cells of the subcuticular region. The whole of the prostomial nervous system, including the visceral ganglion and its branches give off sensory fibers in great abundance. In many cases the sense cells seem to send off sensory fibers direct to the cuticle.

In the front lobular region, besides the sense cells and the ordinary small nerve cells (Figs. 5, 6, 7, 10; d), there are a few large cells embedded in the brain (Figs. 5, 10; f). These have nucleoli and in some cases fibers can be traced from them. They are much smaller than the giant cells (Figs. 11, 8; g) in the ventral nerve cord, more irregular, the structure of the protoplasm is much finer and they are much harder to stain with ordinary stains. Hematoxylin leaves them clear unless a mordant is used. Methylene blue and the other common nuclear stains do not touch them. Villain's copper hematoxylin gives the best results, staining the protoplasm

reddish purple and the nucleus blue-black. These cells are found only in the front part of the prostomium. Associated with these in location are a number of mucous cells which have invaded the brain and from their staining reactions seem to be functional (Figs. 5, 10; h).

Cross-connective part of the brain. The main part of the brain contains the fibrilar cross-connections for the whole brain. The brain cells are practically all confined to the dorsal side. The eyes, four in number, are buried in this cell layer. The central pair is very small and vestigial, none of the lense structure remaining and but little of the pigment. The lateral pair is complete, with lense and cup-shaped pigment layer, but in all of the specimens I have sectioned the eye is inverted, with the pigment outside and the lense facing down toward the brain. As if to render this ocular paradox more striking the perfect eyes are deeply embedded in the head and the degenerate eyes are just under the cuticle. This is a rather interesting example of degeneration.

From the rear of the brain extend the circumœsophageal commissure and the nuchal ganglia. The former is biramous, dividing on each side into a dorsal and ventral branch. This is analogous to the phenomenon found in *Nephtys* where the ocular and surface-sensory parts of the brain are separate structures. (Quatrefages; 44.)

The nuchal ganglia (Figs. 13, 1, 4; i), are connected to the brain by means of two nerves .3 mm. apart, .03 mm. in diameter and 4 mm. long. These nerves come out from the "punkt-substanz" of the brain immediately below and behind the central pair of eyes, follow along the nuchal pits for some distance, when they join on the two nuchal ganglia on their lower front surface. The nuchal pits act as a pair of narrow-mouthed sacks opening, close together just under the lip of the peristomium, enlarging as they go in until they are large enough to contain in their thin chitino-membranous sack, each, a ganglion. The apparatus bears a rather vague resemblance to the otocyst found in *Arenicola* (Ehlers, '92), but inasmuch as there are no otoliths to be found and the only cavity to contain them is very small and pyramidal instead of round, the diagnosis is doubtful. The thing could hardly be functional, but is probably

degenerate or else for some other purpose. The ganglia are connected by their perineurial sheaths in the mid line and the nuchal sacks, though they do not fuse are separated merely by a thin septum. They differ in this respect from *Lumbriconereis erecta* Moore where the ganglia are quite widely separate. Histologically the structure is much the same as the other ganglia of this form. The cells are a little larger than those of the brain and the reticulum is considerably more noticeable.

The subœsophageal ganglion (Fig. 1; j) is of the usual annelid form as is the nerve trunk (Figs. 8, 9). The segmental nerves are given off one pair to each segment from a long narrow pedicle (Fig. 3; k). They follow around the segment just outside the muscular coat. At the base of the foot there is a small ganglion giving off two branches, one to the foot, which branches twice and one passing beyond the foot to the dorsum where it branches extensively in both the epithelium and muscles.

Visceral System. The visceral nervous system (Fig. 4), consists of three visceral ganglia, and a complex system of nerves serving the various pharyngeal muscles. The system originates in a main visceral ganglion (Fig. 4; v), which is situated just below the brain and is equipped with four pairs of symmetrical branches. The front pair of nerve trunks are short and rather thick. They lead to the lateral halves of the brain and their fiber masses fuse with the "punkt-substanz" of this part of the brain. The side branches leave the visceral ganglion at about its central and widest part and lead to the base of the œsophageal connectives. Near where these nerves leave the visceral ganglion a pair of small nerves (Fig. 4; r) about .01 mm. in diameter branch off from the ventral side and extend caudad for a distance of about 2.5 mm. These nerves form an analogue of the complex labio-visceral nervous system found in Eunice. (Quatrefages; '44.) The two hind trunks branch out into the visceral nervous system proper, as diagrammed (Fig. 4). They go straight back, parallel, assuming a diameter of about .04 mm. About 1 mm. behind the visceral ganglion they branch into an outer (Fig. 4; m) and an inner pair (Fig. 4; u).

The outer pair form the maxillary nervous system. They bend ventrad and branch in a very complex manner on either side of the

denticular pouch, serving the complicated musculature of the four pairs of maxillæ.

The inner pair of visceral nerves form the superpharyngeal nervous system. Near where they branch off from the outer pair they partly anastomose, interchanging a few fibers, but with no attendant ganglionic structure. The anastomosis continues for a distance of .16 mm. and then the nerves separate, assuming a diameter of .02 mm. and run parallel about 2 mm. apart for a distance of 1.3 mm. As they do this they bend dorsally so that they are deeply embedded in the upper wall of the denticular pouch and are quite dorsad of the maxillary musculature. This brings them to where the intestine folds off from the dorsal side of the denticular pouch. The nerves bend still more dorsad and become embedded in the intestinal epithelium. Here they become enlarged by ganglion cells and separating (Fig. 4; p), go around the mouth of the intestine proper and come together in the ventral wall of this structure. Just before their second anastomosis they send off two branches into the lateral and dorsal walls of the intestine. These nerves and the one into which the main pair fuses extend back along the intestinal wall for a short distance.

An interesting observation was made on the muscle which acts on the mandibles. It is a long spindle-shaped muscle reaching from the back of the pharynx to the mandibles. These bifurcate black chitinous plates are in apposition to the slit (Fig. 4; 6), whose walls are armed with the maxillæ and form the denticular pouch. The mandibles are bound to the walls of this slit by small muscles used in prehension. Now the members of this group that has the denticular pouch do not completely evert their pharynx in the act of prehension. They merely, from what observations I have been able to make on the Eunicidæ and on this form, push out the mandibles and the forceps jaw of the maxillæ. There is no proboscoideal musculature, such as is found in *Phyllodoce*, *Glycera* and *Nereis*, which functions from the inside and by contracting, turns the proboscis inside out. To take the place of the muscles which evert the proboscis by contracting and pulling it out we have in this form a muscle which, acting on the mandible forces this and the forceps teeth of the maxillæ out and does so, paradoxical as it may seem by

expanding. The fibers in this muscle, instead of running from the origin to the insertion of the muscle as a whole run dorsoventrally from wall to wall so that any stimulus acting on the nerve which supplies this muscle and causing the fibers to contract would cause the muscle to become rigid, of less diameter and of greater length. Since the origin of the muscle is in the back part of the pharynx and since this organ is bound to the body wall by connective tissue and muscles, the "expansion" of the mandibular muscle must force the mandible forward and with it the forceps teeth of the maxillæ, which are closely bound to it. This action extrudes the teeth and a secondary reflex seems to be established that causes them to be snapped together forcibly soon after they are extruded. This reaction is carried on with such vigor that I have known eunicids to bite themselves into two or three pieces while dying in fixatives.

The advantage of this extrusion system over the more primitive proboscoideal eversion found in the forms without the denticular pouch can be seen in the quickness of the reaction, its superior vigor and the fact that the teeth are extruded first rather than as a final consequence of the comparatively slow eversion of a soft fleshy proboscis.

SUMMARY

1. The annelid, *Aracoda semimaculata*, is a highly specialized and evolved member of the lumbriconereidæ, inhabiting the mussel beds near Laguna.
2. Reconstructions were made stereographically as described in this paper.
3. The brain is very complex and highly specialized sensorially. It is divided into the sensory, connective, nuchal and visceral systems, is symmetrical and has a *central* tubal cavity running through the lower part of the main cross-connective portion of the brain, from front to back, parallel to a cavity which is partly filled with muscles and glands, and runs between the visceral ganglion and the main brain and forward between the dorsal and ventral lobes of the fore brain. This *central* cavity, taken together with the very complex and convoluted olifactory forebrain presents an appearance which seems quite similar to that described by Patten in *Limulus* and other invertebrates, but which can probably be best explained

as a mere functional adaptation rather than as a phenomenon of phylogenetic importance.

A. The sensory system is composed of the entire surface portion of the brain, i.e., those parts underlying the surface of the prostomium. The forepart of the brain is subdivided into fourteen to sixteen slender lobes of sensory cellular and inside fibrillar tracts. The sensory cellular tracts are not confined to the lobes in front, but extend all over the brain and give off fibers which connect with the subcuticular sense cells or go directly to the cuticle as sense fibers.

B. The main or cross-connective part of the brain consists principally of "punkt-substanz" with dorsal sense cells.

C. Eyes are four in number, the central pair being degenerate close to the surface of the prostomium, and lacking in lense structure. The lateral pair are well-developed but buried deeply in the prostomium and so inverted that the lens is inside and the pigment outside. Neither pair of eyes can be regarded as functional in the adult.

D. The circum-œsophageal connectives branch on each side into a dorsal and ventral ramus. This is analagous to the phenomenon found in *Nephtys* where the ocular and the surface sensory parts of the brain are separate structures.

E. The nuchal ganglia, extending to the rear from the dorsal part of the main brain are connected with a more or less rudimentary organ which is doubtfully a functional otocyst.

F. The subœsophageal ganglion and nerve cord are of the usual annelid form.

G. There is one segmental nerve extending around the body to a small pedal ganglion, whence it branches into two nerves, a pedal and a dorsal. The former gives rise to a motor notopodial branch and a sensory neuropodal branch. The latter is both motor and sensory in its distribution.

H. The visceral system consists of a labial, maxillary and a superpharyngeal system.

(a) The labial system is degenerate from the much more complex system in *Eunice*, or even in the much more closely related *Lumbriconereis*. It consists of a pair of small short nerves running

down the lateral and ventral walls of the œsophagus and originating in the lateral nerves of the visceral ganglion.

(b) The maxillary and superpharyngeal system originate in the main visceral ganglion which is situated just below the brain. The maxillary system branches repeatedly and serves the complex maxillary musculature. The superpharyngeal system goes straight back to where the intestine folds off. Here it develops a pair of slender ganglia which form a nearly complete circumintestinal ring and send off branches to the wall of the intestine.

4. The muscle which causes extrusion of the teeth is attached to the mandibular plates. It is a spindle-shaped muscle but acts by an increase of length instead of a contraction as is usual in muscles of this shape. This expansion is possible through the fact that the muscle fibers run across the muscle instead of from origin to insertion, and from the fact that the whole muscle is enclosed in a thick envelope of tough connective tissue, which holds the muscle rigid when a contraction of the fibers lessen the diameter and increase the length of the muscle. This adaptation seems to render prehension more efficient.

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(Contribution from the Zoological Laboratory of Pomona College)

EXPLANATION OF FIGURES

- Figure 1. Stereographic reconstruction of the prostomium showing the position of the brain inside of it and the position of the fiber tract inside of the brain. The prostomium is shaded light, the brain darker and the fiber system darkest. The prostomial sensory branches are not shown. $\times 50$.
- Figure 2. Photograph of a wax reconstruction of the brain, showing the visceral and nuchal ganglia darkened. The two hundred odd prostomial sensory branches are shown in this reconstruction. $\times 40$.
- Figure 3. Diagram of the distribution of a segmental nerve.
- Figure 4. Stereographic reconstruction of the ventral side of the brain and of the visceral nervous system. $\times 40$.
- Figure 5. Cross section through the front part of the prostomium cutting through the front lobes of the brain. $\times 50$.
- Figure 6. Cross section of the main cross-connective part of the brain showing the eye, the visceral ganglion and the canalicula that runs through this part of the brain. $\times 50$.
- Figure 7. Cross section of the brain in front of the main cross-connective part where it has divided into two lateral halves. $\times 50$.
- Figure 8. Cross section through the ventral nerve cord near where the segmental nerves come off showing giant cells. $\times 50$.
- Figure 9. Cross section of the above between the origins of these nerves. $\times 50$.
- Figure 10. Enlarged view of the connection of one of the lobes of the fore brain with the subcuticulum. $\times 250$.
- Figure 11. Giant cell and surrounding tissue. $\times 250$.
- Figure 12. Subcuticulum showing sense cells, mucous cells and regular subcuticular cells. $\times 500$.
- Figure 13. Cross section of nuchal ganglia. $\times 50$.
- Figure 14. Diagram of stereographic reconstruction, as described herein of two concentric cylinders; (a) is the first step, showing the cylinders with the topographical reconstruction lines; (b) is the orientation guide, and (c) is the shaded interpretation of (a).

MEANING OF THE LETTERS

(a) parapodia, (b) lateral brain lobes (c) frontal brain lobes, (d) brain cells, (e) fiber tracts, (f) large brain cells, (g) giant cells in ventral cord, (h) mucous gland cells, (i) nuchal ganglia, (j) suboesophageal ganglion, (k) pedicle of neurocord, (l) muscle tissue, (m) outer or maxillary nervous system, (n) inner or superpharyngeal nervous system, (o) maxillary slit opening into denticular pouch, (p) ganglia forming circumintestineal ring, (q) cavity which separates the dorsal from the ventral parts of the brain, (r) labial nerves, (s) subcuticular cell, (t) mucous gland cell, (u) sense cell, (v) visceral ganglion, (w) neural canal.

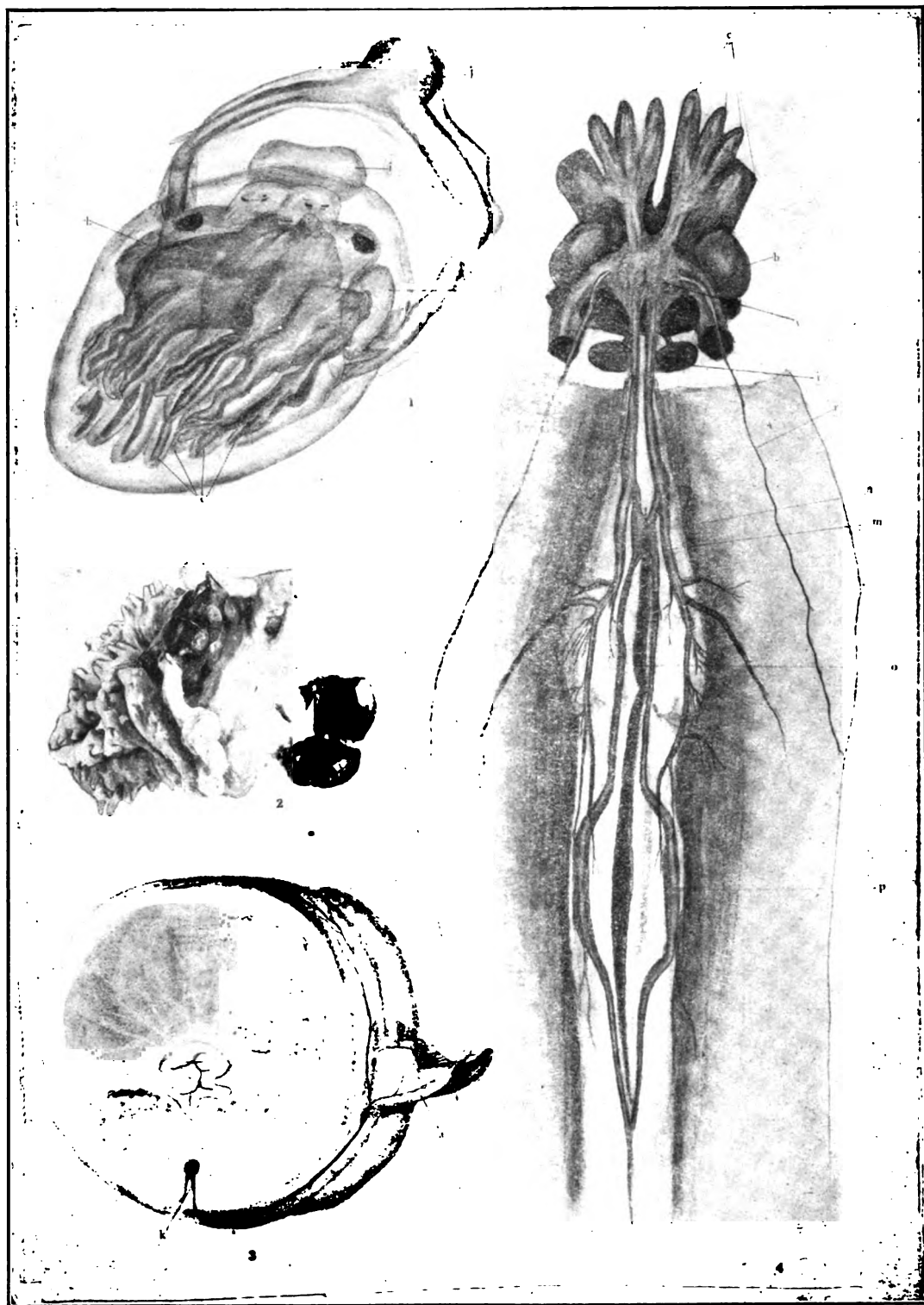


Plate I

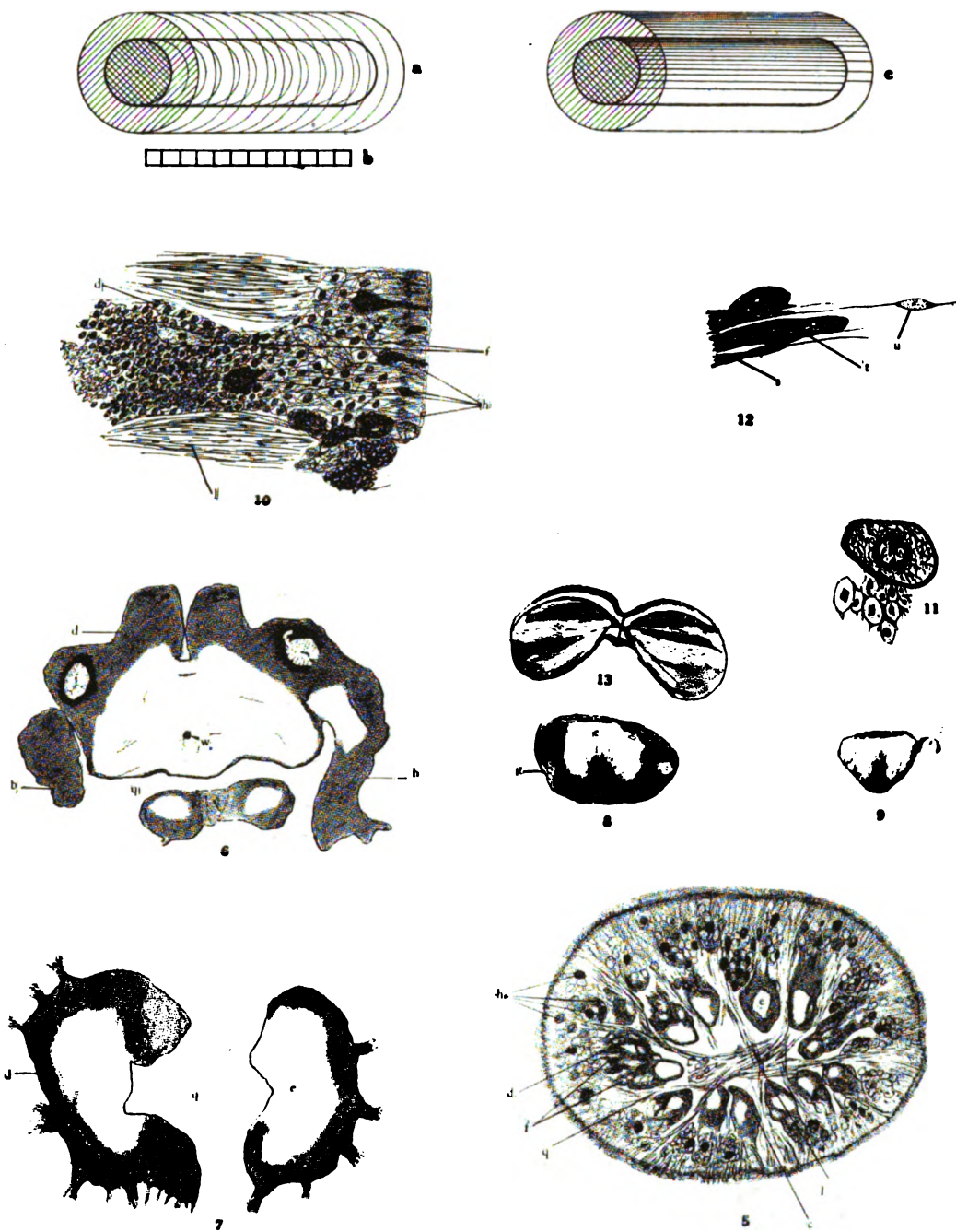


Plate II

The Central Nervous System of the Amphipod *Orchestia*

WILLIAM A. HILTON

Numerous specimens of *Orchestia traskiana* Stim. were collected at Laguna Beach. Some were preserved whole, from others the central nervous system was studied in position or removed in one piece and stained and sectioned or mounted whole. For whole mounts some carmine stain or a light hematoxylin coloration seemed best. For sections a copper hematoxylin was used with good results.

The brain occupies the forward portion of the head with large branches or lobes to the compound eyes which are somewhat dorsal and caudal from the brain as it lies in the head. Large nerves to the antennæ and smaller ones to the antennules cannot be seen from above as they run from near the connectives in a more ventral and caudal region. The brain is held in place by a band of tissue which perforates it near the center. In the figure the brain is not shown in the normal position. It is pulled out so as to show its parts better. The connectives join the rather small first ganglion, running almost ventrally when not displaced. Including this ganglion there are eight large thoracic ganglia and four small abdominal centers, the last of which is a little larger than the other three.

In whole mounts the brain does not show well. The ventral ganglia from surface views are found to contain a coating of large and small cells, especially on the ventral sides. Some of these are shown in the figures, which give views of a large and a smaller ganglion at one optical section. There are several layers of cells and both large and small are numerous, the latter of several sizes very numerous. The general position of some of the larger cells is shown in the figures.

In section the brain is found to be chiefly composed of fibers and fibrils. Large strands of fibers run long distances and connect widely separated regions. No very large cells were found in the brain, such as found in the ventral ganglia, and no very marked central region of the brain was clearly seen. The cells as compared with

the fibers were rather few. Fibrils also were evident, but could not be traced far. Cell groups were most marked in the posterior and lateral regions and fibers from these and to these could be followed as individuals for long distances. Posterior cells were especially numerous connected with the eyes and other parts. The ventral ganglia present no unusual structures in section. In two of the upper ganglia studied there seem to be in each at least two masses of cross fibers or communications.

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- (Contribution from the Zoological Laboratory of Pomona College)

EXPLANATION OF PLATE

- Figure 1. Central nervous system of *Orchestia*. $\times 10$.
Figure 2. Surface view of one of the thoracic ganglia. $\times 75$.
Figure 3. Surface view of one of the abdominal ganglia. $\times 75$.
Figure 4. Longitudinal section through the brain. Caudal end to the top. $\times 75$.
Figure 5. Longitudinal section of the brain; same as Fig. 4 but deeper. $\times 75$.
Figures 6 and 7. Longitudinal sections of the second ventral ganglion. Caudal end at the top. $\times 75$.
Figure 8. Longitudinal section through the first ventral ganglion. Caudal end at top. $\times 75$.

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THE JOURNAL OF ENTOMOLOGY AND ZOOLOGY

William A. Hilton, Editor

Claremont, California, U. S. A.

Some Echinoderms Collected at Laguna Beach

During the summer of 1916 a number of echinoderms were collected at Laguna Beach, some of these have not been found by us before. The determinations are by Prof. H. L. Clark:

Lytechinus anamesus H. L. C.

These little sea-urchins were taken off shore at about 20 fathoms.

Henricia latinscula Fisher

This little starfish was collected by Mr. L. Grow at low tide. The arms are much like those of the common *L. columbiæ* Gray. The central part was yellow, the arms with purple tips.

Stichopus johnsoni Heel.

This large brick-red sea cucumber was obtained in deep water by fishermen. Other holothurians were too small or not properly preserved for certain identification.

Several small brown specimens have been obtained in the past few years belonging to the genus *Thyone*.

Last year several red ones, with black tentacles, were obtained which Dr. Clark thinks are *Cucumaria*.

In 1914 a single young specimen of *Psolus* sp. was obtained in shore. We have not yet found many specimens of sea cucumbers, but these notes may aid a little in determining what we may look for.

(Contribution from the Zoological Laboratory of Pomona College)

Notes on Annelids Collected During 1917 at Laguna Beach

A number of sipunculids were collected but not as yet determined. There was one large species found in the sand at Balboa and one small species found in the sand and in a sponge. At Laguna in the roots of eel grass there were two medium sized forms found, one with smooth gray skin, the other with rough brown skin, and one small kind similar to the small one found at Balboa. In a worm colony of *Sabellaria* a rough kind was found which seemed like one of the others.

SYLLIDÆ

Trypanosyllis gemmipara Johnson. Specimens of this large flat syllid were a light pink. Most were obtained by dredging off shore at a depth of from 10 to 15 fathoms. A few were collected from algæ along shore.

Syllis elongata Johnson. One specimen determined by Hamilton. Others obtained may be the same species.

A large number of other specimens are not yet determined.

APHRODITIDÆ

Several specimens from holdfasts and from dredgings have not yet been determined.

AMPHINOMIDÆ

Erythoe californica Johnson. Under stones.

Euphrosyne aurantiaca Johnson. A number of these short yellow worms were obtained from holdfasts.

POLYNOIDÆ

Halosydna insignis Baird. A large number of these collected among mussels and under stones.

H. pulchra Johnson. Some of these found on *Stichopus*. A number of other specimens have been sent away for determination, including some from the sand flats of Balboa and from among hydroids.

PHYLLODOCIDÆ

Phyllodoce ferruginea Moore. Under stones at Laguna Beach.

P. medipapillata Moore. This was the largest of the family found at Laguna. Among holdfasts and in the tube masses of *Sabellaria californica* Fewk.

A number of other species remain to be determined.

NEREIDÆ

Nereis agassizi Ehl. Very common along shore and in holdfasts.

N. vexillosa Grube. A few of these were determined.

N. procera Ehl. Some of these found with the others of the family.

N. virens Sars. A few specimens, smaller specimens than those reported by Hamilton some years ago.

A number of other species will probably be added from the undetermined material.

NEPHTHYDIDÆ

Nephtys cæca Fab. Low tide, Laguna Beach. One specimen.

LEODICIDÆ

Marphysa californica Moore. A large and a smaller specimen dredged just off shore.

M. stylobranchiata Moore. Collected on the sand flats, Balboa.

Dioparta californica Moore. Dredged off shore at Laguna Beach. Also found on the mud flats at Balboa. The tube of the dredged form is of shell fragments, that from Balboa is made of sand and sticks.

Several other species of the family were collected.

LUMBRINERIDÆ

Lumbrineris erecta Moore. Holdfasts, eel grass. Among the tubes of *Sabellaria californica*.

Aracoda semimaculata Moore. Among mussels.

A number of undetermined forms may belong to this family.

GLYCERIDÆ

Glycera rugosa Johnson. Low tide.

Glycera nana Johnson. Quite a large specimen found at low tide.

ARICIIDÆ

Nainereis longa Moore. Found at low tide.

N. robusta Moore. Found at low tide.

Scolopus elongata Johnson. Balboa sand.

Several others not yet determined.

CIRRATULIDÆ

Cerratus luxuriosus Moore. Low tide. Bright red.

C. spirobranchus Moore. Eel grass roots.

TEREBELLIDÆ

Terebella californica Moore. This seems to be the most abundant of the family at Laguna. In eel grass roots. Red gills, yellow fillaments.

Amphitrite spiralis Johnson. Red-brown, body lighter. Low tide. Laguna.

CAPITELLIDÆ

Specimens which seemed to belong to this family were found at Balboa.

CHLORHÆMIDÆ

Trophonia inflata Tred. Under stones.

OPHELLIDÆ

Ophelina magna Tred. Mostly dredged. Possibly a young of this was collected at Balboa.

O. mucronata Tred. Dredged.

AMPHICTENIDÆ

Pectinaria brevicoma Johnson. Dredged in 10 fathoms off shore. A small but perfect specimen seems to differ from Johnson's descriptions slightly. A number of perfect tubes were obtained.

MALDANIDÆ

Clymenella rubrocincta Johnson. These were abundant on the mud flats exposed at low tide, both at Balboa Bay and Anaheim Landing. Hamilton reported them from eel grass roots near Laguna. I have found some in similar places.

AMMOCHARIDÆ

Ammochares occidentalis Johnson. Several specimens were found among the roots of eel grass at Laguna last Summer. The tube of one specimen at least was made of overlapping but regular fragments of shell. Another specimen was dredged with a similar regular tube of shell fragments.

SABELLIDÆ

A number of species were collected, but none as yet determined. *Sabella elegans* Bush seems to be in the collection. Most specimens were taken from holdfasts or dredged off shore. One was found in the neighborhood of a sabellarian worm colony and some were under rock ledges.

SERPULIDÆ

But few of these were collected.

Serpula colombiana Johnson was the only one determined.

HERMELLIDÆ

Sabellaria californica Fewkes. Enormous colonies of this species are found along the shores in many places.

S. cementarium Moore. This species is usually found farther out and although common is usually found in much smaller numbers in more isolated tubes.

In the lakes back from Laguna Beach and in the streams, a leech is very common. Specimens sent to the U. S. Nat. Museum were determined as *Erpsodella punctata* Leidy. W. A. H.

(Contribution from the Zoological Department of Pomona College.)

Some Chitons Collected During the Summer of 1917

A number of specimens were sent to Dr. S. S. Berry and determined as follows:

Leptochiton cf. *rugatus* Cpr. Small white. Dredged 10 fathoms.

Callistochiton palmulatus Cpr. Dredged 10 fathoms. Ends ribbed.

Callistochiton cf. *decoratus* Cpr. Flat margins of valves rough. 1.15 by 9 mm.
Low tide.

Mophalia juv. cf. *acuta* Cpr. Broad margins, speckled brown irregular spots.
Dredged 10 fathoms.

M. mucosa Gould. Low tide.

Ishnochiton (*Lepidozona*) *clathratus* Rve. Dredged and low tide.

I. (Stenoplax) conspicuus Cpr. Large species, low tide.

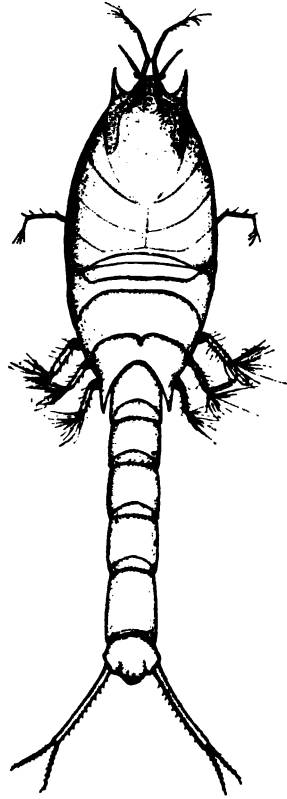
Cyanoplax hartwegii Cpr. Common flat circular form. Low tide.

Nuttallina cf. *fluxa* Cpr. Low tide.

(Contribution from the Zoological Department of Pomona College.)

A Cumacean from Laguna Beach

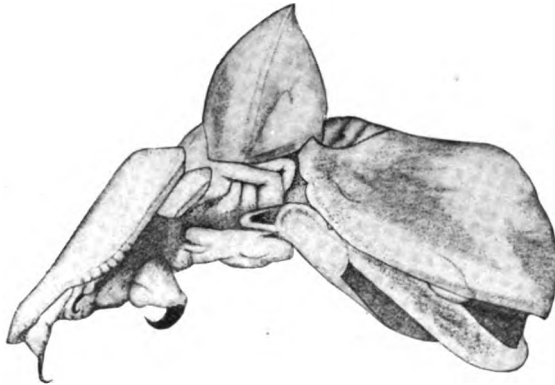
H. H. NININGER



Specimens of a little red-lined cumacean were collected by dredging in about fifteen fathoms of water just off shore, especially near Emerald Bay. These were determined by the U. S. Nat. Museum to be *Colurostylis occidentalis* Calman.

A Parasitic Copepod Found at Laguna Beach

A. M. BEAN AND HARRY STAPLES



Parasitic Isopod

Prof. A. M. Bean obtained the copepod shown in side view, enlarged four times, from the gills of *Mola mola*. The specimen was determined by the U. S. Nat. Mus. at Washington, to be *Cecrops lateillii* Wilson. The drawing is by Harry Staples.

Notes on the Central Nervous Systems of Holothurians

WILLIAM A. HILTON

A number of attempts were made to stain the central nervous system of *Stichopus* with methylene blue, but without success. Dissections were most successfully made when the animals were fixed in hot mercuric chloride. Specimens injected were filled with the fluid and the whole body was later immersed. Specimens with the body distended were obtained in this way and the nerve trunks were easily followed after the removal of the longitudinal muscle bands. Parts of the nerve trunks were removed and sectioned.

Specimens of *Leptosynapta* were imbedded and sectioned whole and a few young of *Stichopus* were sectioned whole.

Very little difference was noted between radial and circumoral nerves at different places. The general character of the nervous system was very much as found in other echinoderms. The deep nerve bands were not well marked in many of the sections, but groups of cells more or less joined with the superficial trunks were found without difficulty.

In adult *Stichopus* the cells are fairly numerous out in the fibrous area of the superficial band. The radial nerves show a bilateral division as there is often a depression on the inner side which approaches the appearance of a cavity.

In my preparations the cell body is not very distinct from the nucleus. There may be six or more layers of cells at the edge of the outer band. The nerve processes consist of many fine strands running in through the fibrous area, but there seems to be in addition to this a groundwork of material which may in large part be made of fibers and fibrils whose identity could not be discovered.

In the younger specimens of *Stichopus* the fibers were more prominent and the cells in the fibrous area were markedly fewer in numbers. The fibers for the most part seem to run the long way of the nerve trunk. Especially were long strands found in the circumoral ring, although fibers could be seen crossing in considerable numbers as well. In the radial nerves the crossing and interweaving of the nerve fibers as they show in cross section is very intricate.

Small nerve trunks were followed along the tubes of the water vascular system. These were seen to have a similar but simpler structure than the radial nerves.

In *Leptosynapta* a very similar sort of nervous system was found, but the nerve cells were larger and on the whole fewer in number. The deep nerve trunks were but poorly represented.

The fibers from the basal cells show very clearly both in the superficial and the deep nerves and the fibers cross in a complex manner at all levels. There are but few cells scattered in the fibrous area and there is apparently but little ground substance. The fibers stand out more clearly than in *Stichopus*. Possibly more fibers from the outer margin cross near the inner. This may be due to the branching at the ends of the fibers.

Fibers and fibrils are all about the same size in *Stichopus* and *Leptosynapta*. The circumoral nerve ring seems thicker than the radial, but this may in part be due to contraction. The fibers in the circumoral ring seem smaller than in the radial. In all parts there are many crossings of fibers in the fibrous portions at all angles.

Small cells at the bases of tentacles are similar to the radial nerves in structure, but with fewer more flattened cells.

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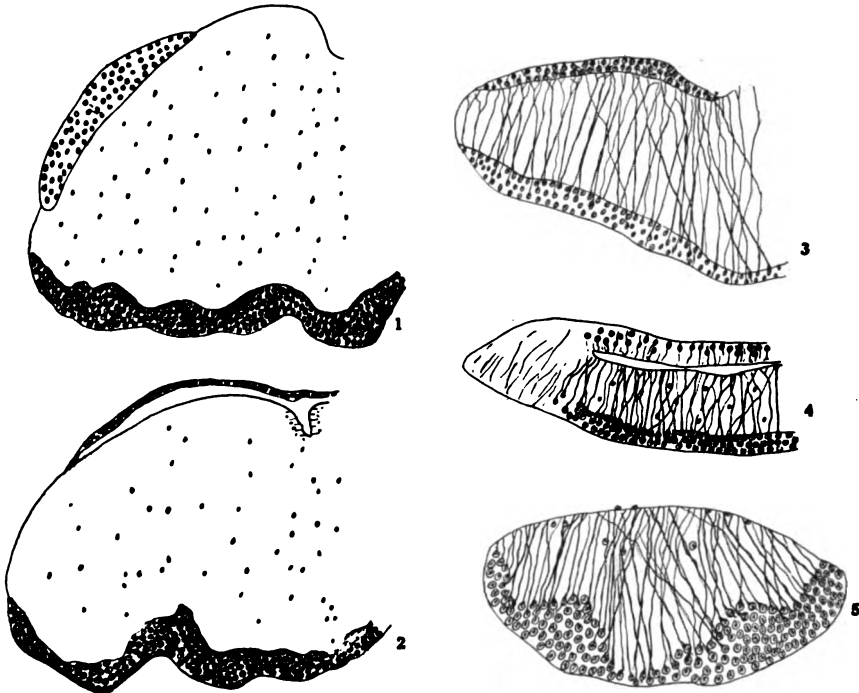
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Central Nervous System Holothurians

Fig. 1 and 2. Drawings of cross sections of the radial nerve of Stichopus. A little more than one-half of the section is shown. The smaller deep strand is shown on the upper side. X 350.

Fig. 3 and 4. Sections through the radial nerves of a young Stichopus. About one-half of the radial nerves are shown in cross section. X 350.

Fig. 5. Cross section of the radial nerve trunk of Leptosynapta. X 350.

(Contribution from the Zoological Department of Pomona College.)

Notes on Flat Worms at Laguna Beach

W. L. GROW, DARSIE L. DARSIE

We have not had any of these determined as yet. We should be glad to collect specimens for anyone who would determine them for us.

One or two kinds of tricladids are found under stones. Most of these are brown or gray, some are pink and some almost red.

At least one species of polycladid is found commonly under stones. They are nearly circular in outline and may possibly belong to the genus *Leptoplana*.

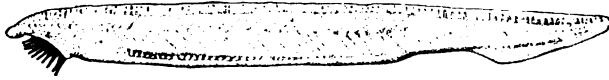
Another species nearly circular in outline was collected by Mr. Grow in 1916. Others were collected in 1917. They were black with narrow longitudinal red lines.

A large grey species was collected by Mr. Darsie in 1917. Two were obtained in a tide pool near Boat Cañon. They swam by means of rapid undulating movements of the frilled edges of the body.

(Contribution from the Zoological Department of Pomona College.)

BRANCHIOSTOMA CALIFORNIENSE GILL

Specimens of Branchiostoma have been dredged at Laguna Beach for the past three years. Prof. A. M. Bean first brought them in from just beyond the Laboratory in from 10 to 15 fathoms of water. Almost every haul near this place in the coarse



rough sand and shell debris which is abundant there. The drawing is by Charlotte Johnson.

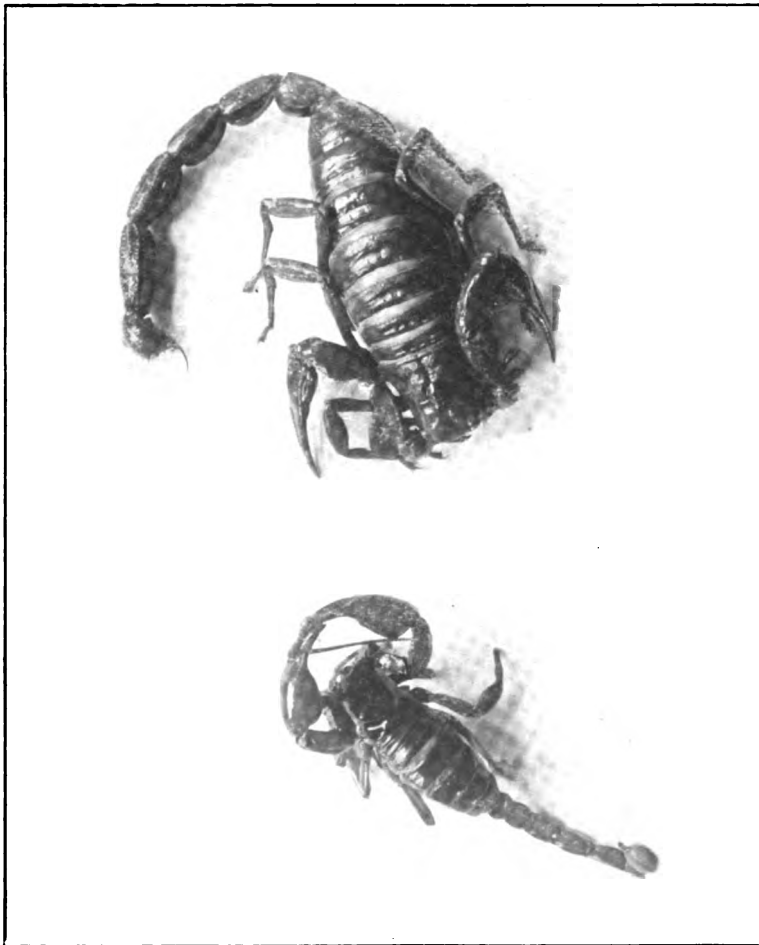
Further Observations on the Mountain Sheep of the San Gabriel Range

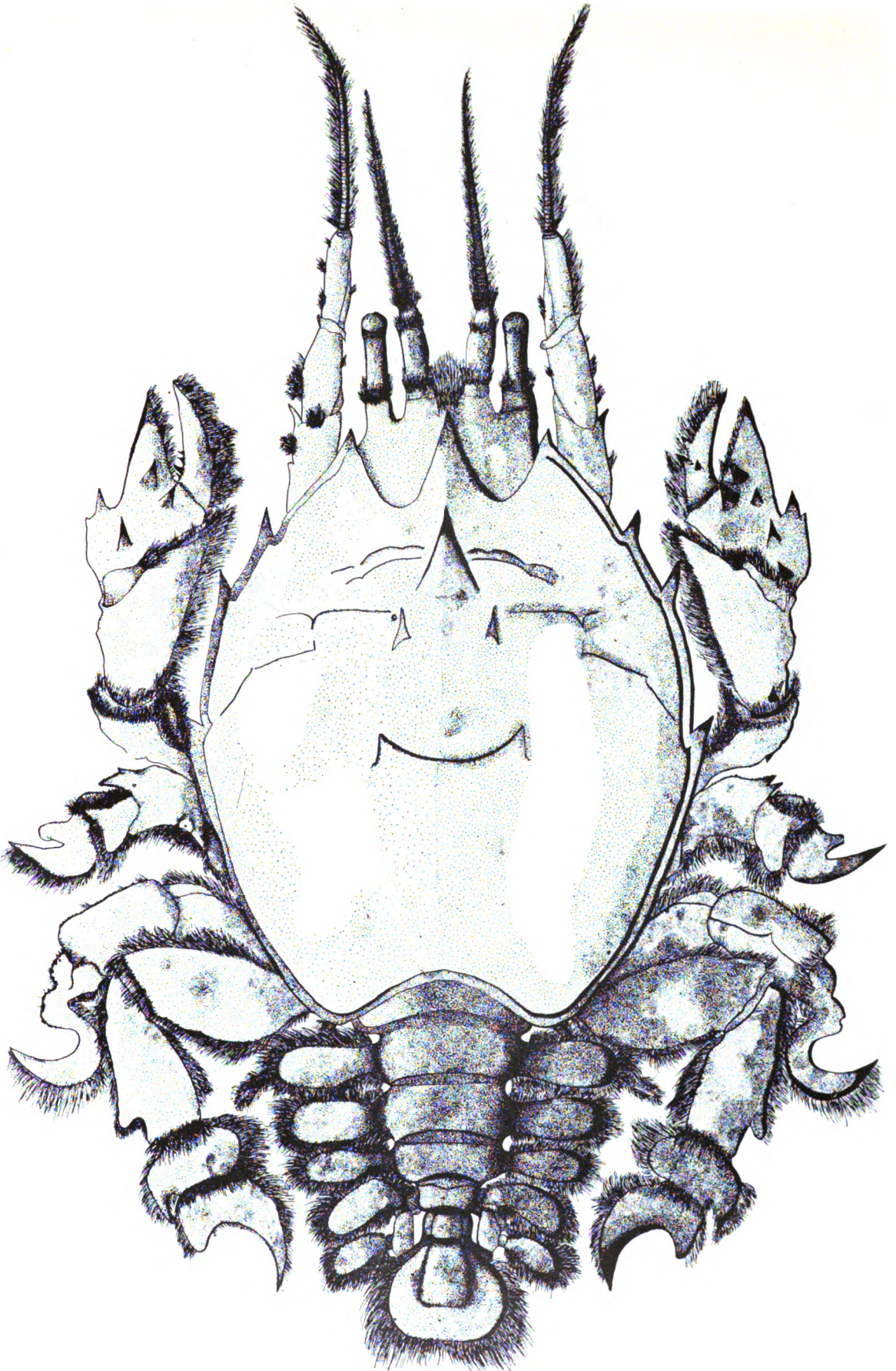
WILLIAM A. HILTON

On the 15th of December, 1917, I had the good fortune to come upon quite a number of the mountain sheep which range over some of the highest and roughest elevations of these mountains. Occasionally one or several sheep have been seen by those who have been climbing over Ontario, Cucamonga or Telegraph peaks. As a rule the animals are very shy and give nothing more than a glimpse. The exact identity of these animals and their total number remains unknown. It has been suggested that they are *Ovis canadensis nelsoni* C. H. M. These that I saw are much like the specimens in the college museum which were collected in Lower California, but the horns of the male seemed more massive in the San Gabriel specimens so far as I could keep the size and proportions in mind. Just how many Mountain sheep there are in this range we have no clear way of telling. I believe that the rather large band which I saw is not all of them. Those seen by me on December 15th were within a hundred feet from the top of the ridge of Ontario peak. They were in the dense forest which grows near the top of the mountain on the San Antonio cañon side. As we ascended the trail we came in sight of seven or eight adult animals partly hidden among the bushes. They were not farther than one hundred and fifty feet away and did not at first see us or take alarm, so it was possible to watch them for some time. When a large ram caught sight of us he suddenly stopped walking about and eyed our every movement, then when we came a little nearer the whole band ran to the top of the ridge and it was possible to count them. There were twenty-four in all, at least six large rams, six females and six half grown young. The exact number of each was impossible to make out.

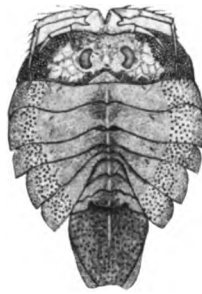
Scorpions from the Claremont-Laguna Region

The two species of scorpions which have been found in the Claremont Laguna Region are shown in the accompanying photograph by L. Cooper. The smaller, *Anuroctonus pharodactylus* Wood, is found throughout the region except in the higher mountains. The larger *Hardurus hirsutus* Wood, is more of a desert species and seems to be confined to the more desert portions of the region.





Blepharipoda occidentalis Randall.
Specimen from Laguna Beach. Drawing by J. Caldwell.



Serolis carinata Lock. Drawing by Staples.

Notes on Sponges at Laguna Beach

W. L. GROW

During two summers Mr. Grow collected and studied sponges at Laguna Beach. We have not been able to get any of the local forms satisfactorily determined, and the notes here given are simply suggestions. We shall be glad to turn over an abundance of material to any one who wishes to work on the group.

At least three kinds of simple calcareous sponges were found under rocks and on kelp holdfasts.

Leucosolenia sp.? is found at times under rocks at low tide. The sponge is about 10 to 12 mm high and narrower at the base, white, slender, not very abundant.

At least two species of *Sycon* or *Grantia* were found under stones and on holdfasts. Those from deeper water have longer spicules.

The most conspicuous sponge at Laguna is found in masses under rock ledges. It is often quite large and irregular in outline. It is sometimes divided into many partially separate colonies and again it may occur in a smooth mass. It is pure white. Possibly it belongs to the genus *Petrostoma*. In its cavities several animals often retreat, small crabs of the genus *Pachygrapsis* and young and adults of the crab *Pachycheles rudis* Stimp. and the isopod *Cirolana harfordi* var. *spongicola* Staf.

A species of *Clathrina* occurs at Laguna Beach now and then. During some winters this stalked white, mushroom-like species is found among tufts of Bryozoa.

The so-called sulphur sponge is common under stones and rock ledges. There is no differentiation into individuals, the oscula are scattered over the surface, which may be very irregular. Great masses of these yellow sponges are often found. The only animal associated with them seems to be the limpet *Tylodina fungina* Gab.

Pink encrusting sponge. Found on shells, seaweed, etc. Pink-white, smooth, few openings evident. Calcareous spicules triaxons and monaxons. It is rather thin.

White encrusting sponge (I). White, fused at the base, but with distinct, erect individuals each with osculum. Often covered with Bryozoa. Triaxon spicules and spongin fibers present. Under ledges of rock.

White encrusting sponge (II). Soft white, but tenaceous. Peels off from shells and twigs. Has only triaxon spicules. Found on rock surfaces, seaweed, kelp holdfasts.

Red sponge. Bright red, feels spongy. Encrusts a base and sends out tufts which fuse. Triaxon spicules. Spongin fibers, rather broad cavities. On seaweeds and under rocks.

Yellow sponge. From a yellow to an ocher. Never the color or texture of the sulphur sponge. Semi-encrusting with some erect irregular portions which may fuse again with the parent mass. Parts may wind and twist among bryozoan masses. Monaxon spicules, granular structure. Surfaces of rocks, rock ledges and seaweeds.

White dermal sponge. Soft spongy, greyish white. Fibers or strands easily seen by the naked eye. Grows under ledges. Composed of spongin fibers. Some dry bits cast up on the shore seem to be of as good quality as a first class bath sponge.

Massive pink-white sponge. These are calcareous in part, pink on the surface and very dense. Channels not well marked. Large masses under rock ledges.

In addition to the above there is a very bright red sponge which is found under stones.

At Balboa bay among some oysters there is a large irregular pyramidal dermal sponge of a dark brown color.

(Contribution from the Zoological Department of Pomona College.)

The Central Nervous System of a Long-Armed Serpent Star

WILLIAM A. HILTON

The specimens were found in the sand of Balboa Bay. A specimen was determined by Dr. Clark as probably *Amphiodia barbaræ* Lyman. When obtained these creatures move their arms very vigorously. When in the sand they bury themselves very effectively. Out of the sand the arms are not moved to so good purpose, and they become tangled.

The great length of the arms and the smallness of the disc made these interesting objects for study. Sections were made of the arms close to the disc and at their tips. In the specimen from which the sketches were made, the arm sectioned was 250 mm long and the disc 10 mm in diameter. The arms do not taper much and the radial nerve is about the same size for some distance. At about one centimeter from the tip of the arm the diameter of the nerve trunk is much less to correspond to the smaller diameter of the arm. At the very tip of the arm the nerve cord is of course very much reduced, but it is larger in proportion than it was at other parts of the arm. (Contribution from the Zoological Department of Pomona College.)

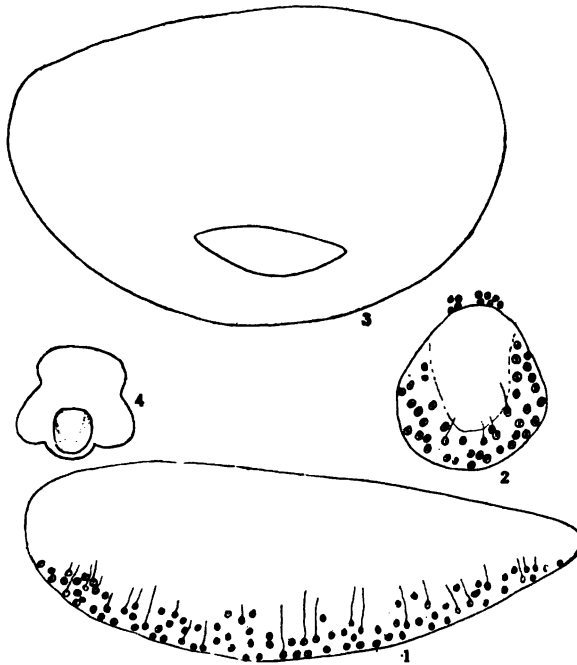


Fig. 1. Cross section of the radial nerve of *Amphiodia*, section taken near the disc. X350. Aboral side up.

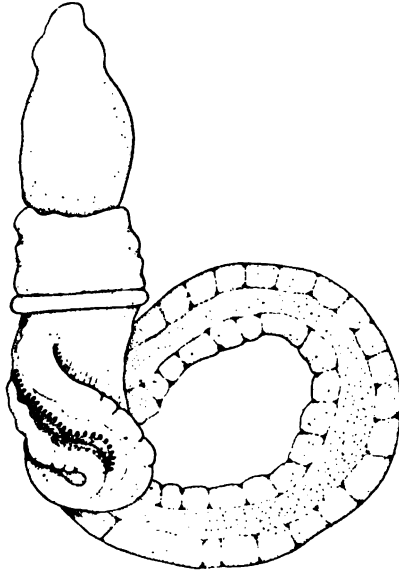
Fig. 2. Section across the radial nerve near the tip of the arm. Aboral side up. X350.

Fig. 3. and Fig. 4. Sections across the arm at the base and at the tip, showing the outline of the arm with the nerve trunk within. Aboral side up. X70.

Dolichoglossus Pusillus Ritter

WILLIAM A. HILTON

The writer first discovered the occurrence of *Dolichoglossus* in the sand flats at Balboa Bay, in August, 1917. In one little cove they were found to be very abundant. Large numbers of old burrows were evident in many places and the castings in some places gave clear indications of many animals. In certain places they were the most abundant animals. Specimens were collected once or twice a month for several months, and a large number of tubes were examined for embryos. Eggs and young of various stages were obtained at almost any time, so it seems quite possible that there is no absolute breeding season. Further observations may settle this point a little later. The sand cases or burrows are so delicate that they are easily broken,



yet the best way to collect the eggs and adults seems to fix large numbers of the animals within the cases and then later open the sand tubes and remove the specimens. In some cases the living animals were taken within the tubes and later removed at the laboratory.

Other places where *Dolichoglossus* occurred were found to be on the mud flats the other side of the bay from the first situation and in fewer numbers at Anaheim Landing. Later a few were obtained under eel grass not far from the Laboratory at Laguna Beach.

(Contribution from the Zoological Department of Pomona College)

Pycnogonids Collected During the Summer of 1917 at Laguna Beach

WILLIAM A. HILTON

During the summer no particular attention was given to the collection of these creatures, but all that were found were saved. Some places where they were known to be abundant were not searched at all. In consequence of this, the larger forms were especially obtained, especially those found under stones. There are a number of new locality records. Something over 200 specimens were collected.

Pallene californiensis Hall. One specimen Aug. 19.

Lecythorhynchus marginatus Cole. One with eggs, date? Some young, in all 38, most were found among stones, among muscles and a few in red algæ.

Ammothella tuberculata Cole. In August 8 specimens. No eggs. Sept. 1, 7 under stones. Sept. 13, 2 specimens. Sept. 16, 8 of which three had eggs. In all 25.

A. bi-ungiculata var. *californica* Hall. During July 4 specimens, one with eggs. August, 11 with eggs, 21 without. September, 15 with eggs, 13 without. In all, 64.

Ammothella spinosissima Hall. August, 2 with eggs, 16 others. September, 1 with eggs, 2 without. September 16, 3 without eggs. These last were found in among the worm cases of *Sabellaria californica*.

Ammothella spinifera Cole. Five specimens with eggs under stones during August, one specimen without eggs.

Tanystylum intermedium Cole. July, six specimens in Bryozoa. August, 17, three among alcyonarian colony. No eggs. August, 19, under stones, one with eggs, five others. September 1, 14 without eggs, one with. Stones.

T. orbiculare Wilson. One specimen with eggs under stone. August. Eight among red algæ, no eggs. September 1, 17 without eggs, four with eggs under stones.

Clotenia occidentalis Cole. One specimen with eggs and young dredged, Aug. 27. One specimen without eggs.

Anoplodactylus californicus Hall. One without eggs dredged August 27. One under a stone, August. No eggs.

Phoxichilidium femoratum Cole. Sept. 1st, one immature.

Halosoma viridentestinalis Cole. Among Bryozoa and under stones. Aug. 19, two with eggs, four others. Sept. 1, one with eggs, five others.

Eurydice spinosa Hilton. One with eggs, August 17. Locality uncertain. Four with eggs, one without, Sept. 17, 1917, from holdfast.

This species was described from a specimen collected at Laguna Beach in September, 1915. Judging from the number of specimens obtained from the holdfast, the species seems to be from deeper water.

Pycnogonum sternsi Ives. Sept. 2, four young under stones. Sept. 3, one young.

Nymphon sp.? Sept. 1, one species of what apparently belongs to this genus was found, a single specimen well inshore.

Species living among colonies of *Sabellaria californica* were:

Ammothella bi-ungiculata var. *californica* Hall. *A. spinosissima* Hall.

Deep water forms seem to be: *C. occidentalis*, *A. californicus* and *E. spinosa*.

(Contribution from the Zoological Department of Pomona College)

Some Echinoderms of Laguna Beach

In the summer of 1915, Prof. A. M. Bean dredged an injured specimen of heart urchin. It seems to be the same as the one labeled *Lovenia cordiformis* Gray, in the museum of the Scripps Institution at La Jolla.

Since 1915 we have dredged large numbers of the little urchin, *Lytechinus anamesus* H. L. C., Det. H. L. C.

The sand dollar *Dendraster excentricus* Esch. has been dredged every summer, especially off Emerald Bay. It is also very common in places on the mud flats at Balboa and Anaheim Landing.

The starfish *Ludia foliata* Grub. has been obtained but once. The starfish *Henricia latinscula* Fisher Det. H. L. C., whose central parts were yellow and whose arms had purple tips, has been collected but once, by Mr. Grow in 1916.

But one specimen of the basket star has been taken. It was determined for us by Dr. H. L. Clark. It is *Gorgonocephalus eucnemis* M. & T.

The following serpent stars have been found every summer at low tide: *Ophioderma panamensis*. Lutk. Det. H.L.C. is the largest species. *Ophioplocus esmarki* Lyman, Det. H.L.C. Usually unicolorous. *Ophionereis annulata* Le Conte. Compared with Fisher's determined specimens. *Ophiothrix spiculata* Le Conte. This variable and beautiful form is found in many places, among mussel beds, in holdfasts and dredged.

Ophiocryptus maculosus Clark. Det. H. L. Clark. These have been collected from holdfasts.

During the summer of 1917 a curious long-armed serpent star was collected. It was determined for us by Dr. H. L. Clark, but as the disc fell off the determination is not quite sure. "I am cataloging it as *Amphiodia barbara* Lyman, known only from Santa Barbara. But the arms of this specimen are much longer than the typical *barbara*, so it may be *urtica*. One must have the disc to be sure."

We hope to collect more specimens of this another summer. The holothurians so far are as follows:

The common *Stichopus californicus* Stimp. and the large red dredged *S. johnsoni* Heel.

Several specimens of a brown *Thyone* have been obtained. Several red with black tentacles which Dr. Clark thinks may belong to the genus *Cucumaria*. Another specimen sent in 1917 to Dr. Clark, "It is apparently *Cucumaria curota* Cowles."

In 1914 a single specimen of *Psolus* Sp. was obtained.

White and pink specimens Dr. Clark has determined as *Leptosynapta inhaerens* O.F.M.

(Contribution from the Zoological Department of Pomona College)

A List of Odonata Chiefly from Laguna Beach

DANSIE L. DARSIE

The determinations were made for us by Dr. Munz.

DRAGON FLIES

Libellula saturata Uhl. Sub. Sp. *croceipennis* Selys. Found at Laguna and Claremont. Common large form with red-brown body and basal two-thirds of wings red-brown.

Plathemis lydia Durury. Large. Wings banded near body and near center. Female has slighter bands. Common Claremont and Laguna.

Sympetrum illotum Hagen. Medium size. Tinge of brown on clear wings, dark brown body in dry specimen. Laguna Beach.

S. corruptum Hagen. Medium size. Clear wings, light body. Common Claremont and Laguna.

Aeshna multicolor Hagen. Large. Clear wings, colored body. Laguna.

Erythemis simplicicollis Say. S. sp. *collocata* Hagen. Medium size. Clear wings, blue body. Laguna Beach.

Tramea lacerata Hagen. Chocolate brown marks at base of hind wings. Laguna Beach.

Anax walsinghami MacLachlan. Clear wings. Very large. Our largest species. Laguna Beach.

DAMSEL FLIES

Heterina americana Fab. Base of wings bright red. Claremont and Laguna.

Argia virida Hagen. Male blue body. Clear wings. Claremont and Laguna.

Emallagma cyathigerum? Carpentier.

Calaenura denticollis Burmeister. Very small. Claremont.

Amphiagrion saucium Bur. Red body. Very small.

(Contribution from the Zoological Department of Pomona College)

A List of Small Mammals from the Claremont-Laguna Region

HALSTEAD C. WHITE

The mammals were all but several bats collected by H. G. White. All determinations are by the Museum of Vertebrate Zoology of the University of California.

Myotis evotis Allen. Long-eared bat. Claremont.

Nycteris borealis teliotis Allen. Western Red Bat. Claremont.

Scapanus latimanus occultus Grinnell and Swarth. Southern California mole. Claremont and Webber's camp, San Gabriel Canyon.

Reithrodontomys megalotis longicauda Baird. Long-tailed Harvest Mouse. Glen Ranch. Santa Ana River.

Peromyscus maniculatus gambeli Baird. Gambel White-footed Mouse. Santa Ana River. Pomona Hills.

P. californicus insignis Rhoads. Southern Parasitic Mouse. Glen Ranch. Claremont. Laguna Beach.

P. eremicus fraterculus Miller. Dulzura white-footed mouse. Claremont. Laguna Beach.

Neotoma fuscipes macrotis Thomas. Long-eared Wood Rat. Laguna Beach.

N. intermedia intermedia Rhoads. Intermediate Wood-rat.

Microtus californicus californicus Peale. California Meadow Mouse. Coble's canon. Santa Ana River, near Corona.

Mus musculus Lin. At Laguna Beach, not far from houses.

Perognathus californicus femoralis Allen. Dulzura Pocket Mouse. Glen Ranch. Laguna Beach.

Tomomys bottae pallescens Rhoads. San Diego Pocket Gopher. Glen Ranch.

(Contribution from the Zoological Department of Pomona College)

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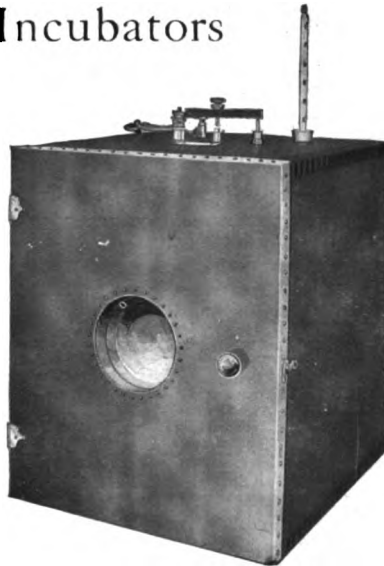
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